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Physician Hospital Privileges: Implications for a Medical Staff Policy

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Executive Summary

The Administration's health reform package includes a proposal that would reduce Medicare's payment to physicians on medical staffs whose service volume per admission consistently and significantly exceeds the national median. If a physician belongs to more than one medical staff, payment might be withheld for services in one hospital and not another. Although this is similar to belonging to more than one Independent Practice Association (IPA), an issue arises regarding the medical staff affiliation patterns of physicians. If physicians have affiliations at several hospitals, they might direct their admissions to one hospital versus another. Some shifting might be desirable--shifting admissions out of high-cost hospitals could lower physician service volume. On the other hand, this shifting could also threaten the viability of certain hospitals.

This paper examines physician affiliation patterns and seeks to answer two fundamental policy questions: (a) how many hospitals are physicians affiliated with? and (b) what proportion of their practice occurs in a single hospital? To shift admissions between hospitals, physicians must have more than one affiliation. Understanding current affiliation patterns is important because these patterns will dictate physicians' ability to shift admissions in the short run. Beyond these policy questions, this paper endeavors to more fully understand physician affiliations and practice patterns. To that end, several additional issues are explored.

Data. Our analyses primarily depend on a database developed using HCFA's National Claims History System (NCHS). From the NCHS we obtained 100 percent claims data (inpatient hospital facility bills and physician bills) for the last six months (July-December) of 1991 for seven states--Alabama, Florida, Indiana, Kansas, Missouri, Oregon, and Utah. These states were chosen because they have high-quality data on unique physician identification numbers (UPINs), which are essential to much of this analysis, and because they provide some geographic diversity. Hospital facility bills were linked with physician bills based on beneficiary identification and dates of service to identify physician services provided during the hospital stay. Relative value units (RVUs) from the Medicare Fee Schedule were assigned to physician services, enabling us to measure physician service volume and intensity per admission. Although data are reported for all physicians, we focus on the attending physician because these physicians control hospital admissions and presumably manage care during the stay. We identify the attending physician based on services provided during the admission.

We also use the 1992 national Medicare Patient Analysis and Review (MedPAR) file, which contains 100 percent of Medicare admissions and includes the UPIN of the attending physician. The 1992 MedPAR file allows us to replicate for the nation as a whole our analyses of affiliation rates and the proportion of services provided in a single hospital.

Average Affiliations and Concentration of Services. We find that attending physicians have few affiliations, about one and one-half (1.55) on average, and that 63 percent have one affiliation (see Table 3). Surgical specialties have the highest average affiliations (1.76), followed by medical specialties (1.62), general/family practice (1.34), and other physicians (1.26). The national file yielded similar results.

We measure the concentration of an attending physician's services across hospitals by summing the attending physicians's RVUs for each hospital and dividing by the total RVUs for the attending physician. Although we refer to the "attending physician's RVUs", services provided by all physicians involved in the admission are assigned to a given attending physician.

The overwhelming majority, 90 percent, of physicians' Medicare services are provided in a single, primary hospital (see Table 4). Only about 3 percent of Medicare attending physicians provide less than 50 percent of their services in a single hospital. These findings are generally consistent across specialty category, although surgical specialties as a group have somewhat lower service concentration (86 percent) than general/family practice (93 percent), medical specialties (89 percent), and other specialties (94 percent). Again, the national file produced similar results.

Implications for a Medical Staff Policy. These results may allay concerns that large-scale shifting among hospitals will occur in the short-run. On average, attending physicians have few affiliations, most have one, and the overwhelming majority of their services are provided in one, primary hospital. In the long run it is important to remember that although the implementation of a medical staff policy would create an incentive for the individual physician to obtain more affiliations (thereby increasing the opportunities to shift admissions), the policy also creates an incentive for the medical staff to carefully review the granting of affiliations. Furthermore, changes in the legal and economic climate have made the process of obtaining affiliations more rigorous over the last few years. With respect to the viability of hospitals, the proposed legislation requires adjustors for teaching activity and disproportionate share status.

Other Results. We also find that in the typical hospital about 20 percent of attending physicians account for 55 percent of Medicare inpatient physician services. Thus, the average medical staff has about 13 physicians who are responsible for managing the majority of Medicare physician services. Even in major teaching hospitals, where 63 percent of services are accounted for by 20 percent of physicians--this is an average of only 28 physicians. These results suggest that medical staffs could focus on a relatively small number of attending physicians to successfully effect change in the performance of the staff as a whole.

The next issue we examine is the question of what determines whether a medical staff is high-cost or not. We hypothesize that certain hospital medical staffs develop an organizational culture that encourages aggressive treatment and that this practice style may be encouraged by the presence of high technology. However, using ANOVA techniques, we find that it is the practice styles of individual physicians, as opposed to the practice style of the staff as a whole, that largely determines whether a given hospital is high-cost or not. That is, high-cost physicians appear to be high-cost regardless of the hospital in which they are practicing at the moment. This suggests that one focus of medical staffs should be the practice styles of individual physicians. The fact that relatively few attending physicians control most services suggests that "physician profiling" could (perhaps initially) focus on the practice patterns of these physicians.

Finally, we compare attending physicians with one versus multiple affiliations, finding that multiple-affiliation physicians are more specialized. More importantly, however, multiple-affiliation physicians provide 13 percent more services per admission, after controlling for casemix. This result holds within specialties. Coupled with the dominance of individual practice styles, a medical staff policy would appear to give staffs an incentive to discourage multiple affiliations.

I. Introduction

This paper examines patterns of physicians' hospital affiliations. Its first motivation relates to Medicare cost containment policy. Our previous research has developed strategies that put the medical staffs of hospitals at risk for Medicare inpatient physician services (Miller and Welch 1993a; Welch and Miller 1993).[1] One such strategy, referred to as the high cost medical staff policy, was included as part of the Administration's health reform package. Under this policy, Medicare's payment to the physicians on medical staffs whose service volume per admission consistently and significantly exceeds the national median would be reduced.[2] Briefly, the volume per admission of each staff in the country would be calculated for a base year (1996); urban medical staffs exceeding 125 percent and rural staffs exceeding 140 percent of the national median would be designated "high-cost." During a given performance year (e.g., 1998), 15 percent of Medicare payment would be withheld from each bill submitted by members of high-cost staffs. At the end of the performance year, the staff would be reevaluated relative to the threshold. If the staff responds to the incentives of the policy and performs below the threshold, the withhold is returned (with interest). Alternatively, depending on how far the staff is above the threshold, some or none of the withhold is returned.

If a physician belongs to more than one staff, the physician is treated as if he or she is in two different risk pools. Thus payment might be withheld for Medicare admissions to one hospital and not another. Although, physicians belonging to more than one medical risk pool is similar to belonging to more than one Independent Practice Association (IPA), an ideal arrangement is for each physician to be associated with a single medical staff--the incentives of the policy would be more clearly focused.

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[1] Throughout this paper we will refer to hospitals and medical staffs. "Hospital" generally refers to the institution as a whole and "medical staff" generally refers to the physicians practicing in the hospital. That is, physicians have affiliations with a hospital and belong to the medical staff. These terms will be used interchangeably to the extent that hospitals can not function without medical staffs and vice-versa.

[2] The medical staff's performance would be judged based on relative value units (RVUs) per admission, adjusted for casemix, teaching activity, and disproportionate share status. (In later years the Medicare program might consider expanding to policy to forestall the unbundling of services outside the hospital stay, see Appendix A for discussion).

One concern that arises under such a policy relates to the affiliation patterns of physicians. If physicians have affiliations at several hospitals, they might direct admissions to one medical staff versus another. Some shifting might be desirable--shifting admissions out of high-cost medical staffs could lower physician service volume. On the other hand, Ginsburg (1993) raises the concern that a medical staff policy could give rise to "scenarios of physicians with staff privileges at more than one hospital moving their practices away from either hospitals in which physicians receive lower payment rates or those seen as interfering the most in physicians' practices." Ginsburg points out that this situation creates a better basis of competition between hospitals than the traditional method of duplicating services but at the risk of potentially creating instability for certain hospitals where physician staffs are leaving and taking both Medicare and non-Medicare admissions with them.[3]

This paper seeks to answer two fundamental policy questions: (a) how many hospitals are physicians affiliated with? and (b) what proportion of their practice occurs in a single hospital? To shift admissions between hospitals, physicians must have more than one affiliation.[4] Understanding current affiliation patterns is important because these patterns will dictate physicians' ability to shift admissions. Although a high-cost medical staff policy could create an incentive for the individual physician to obtain multiple affiliations, it is important to remember that the medical staff's incentive is to monitor the treatment patterns of its member physicians and to grant privileges to physicians, at least in part, on the basis of their practice styles. Furthermore, as we will discuss below, it has become more rigorous over the last few years to obtain affiliations. If physicians currently have few affiliations and their services tend to be concentrated in a single hospital, shifting admissions (either by moving admissions among existing affiliations or by gaining new affiliations) should be more difficult.

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[3] Two additional concerns regarding shifting are: (1) that a physician may shift admissions so he or she is not penalized, although as mentioned this could result in lower volume; and (2) shifting could affect beneficiary admission patterns.

[4] And the incentive is only present when one staff has been designated high cost and the other has not.

The concern underlying shifting is that certain hospitals would not remain viable. Beyond our analysis of affiliation patterns and the potential for shifting, a couple of other points are relevant. The policy includes PPS-like adjustment for teaching activity and disproportionate share status, two classes of hospital that viability concerns are typically raised over. Additionally, recall that the policy relates to Medicare admissions, which account for one-third of all admissions. Thus while incentives are present, they do not relate to all admissions.

In addition to the policy motivation, there is the general motivation of more clearly understanding physician practice patterns. To that end, several questions will be addressed. If physicians have primary and secondary affiliations, do the types of hospitals differ (e.g., primary affiliation in a nonteaching hospitals, secondary affiliation in a teaching hospital)? Do physicians tend to direct more complicated patients to one affiliation versus another? Do the characteristics of high affiliation versus low affiliation physicians differ, e.g., are they younger? Do their practice styles differ? Are most of the services provided by a medical staff accounted for by a few physicians? What role does the medical staff as a whole versus the individual physician play in determining whether a hospital provides greater or lesser physician resources per admission than other hospitals?

The next section of the paper relates our general approach to data construction. Section III examines the definition of medical staff affiliations. In Section IV we discuss average numbers of hospital affiliations and the concentration of services across these affiliations, overall and by specialty. The remaining sections of the paper take up each of several issues in turn. Section V explores patterns of primary affiliation by hospital type (e.g., teaching/nonteaching); analyzes casemix in physicians' primary and secondary affiliations; and compares the characteristics (e.g., age, specialty) and practice styles of physicians' with few affiliations versus those with multiple affiliations. Section VI addresses the question of whether "high-cost" medical staffs are collections of high-cost physicians or whether there is a practice style or culture peculiar to the staff that results in higher costs. Section VII examines the issue of service concentration within the medical staff, i.e., do a few physicians account for most services? The final section is comprised of a discussion of policy implications.

II. Data Base Construction

Using HCFA's National Claims History System (NCHS), we obtained 100 percent claims data (inpatient hospital facility bills and physician bills) for the last six months (July-December) of 1991 for seven states.[5] Hospital facility bills were linked with physician bills based on beneficiary identification and dates of service (i.e., all physician bills from admission to discharge, inclusive).[6] Each hospital bill includes a provider identification number that allows us to link the admission with various hospital characteristic files (e.g., HCRIS and Provider Specific File). This allows us, at various points in the analysis, to summarize by hospital characteristics (e.g., urban and rural location). Similarly, each physician bill includes a unique physician identification number (UPIN) allowing us to link physician services with a physician characteristic file (e.g., age, specialty).

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[5] The seven states are Alabama, Florida, Indiana, Kansas, Missouri, Oregon, and Utah. These states were chosen because they have high quality unique physician identification numbers (UPINs), which are essential to much of this analysis, and because they provide some geographic diversity.

At various points in the analysis we will be interested in the physician resources per admission. Effective January 1, 1992, Medicare reformed its method of paying physicians and now uses a fee schedule based on Relative Value Units (RVUs). We use RVUs to measure physician services per admission because they represent a more direct measure of volume and intensity. By way of contrast, one could measure physician services using charges, but even charges deflated for geographic fee variations are likely to reflect distortions in fees resulting from historical reimbursement practices.

Thus, it was necessary to assign RVUs to physician bills. The RVU assignment process involved a number of complex decisions which are discussed in detail elsewhere (Miller and Welch 1993). Briefly, the number of RVUs for each physician bill are obtained by assigning RVU values for the service (based on the HCPCS code and modifier) and then multiplying by the number of services on the bill. The complete file contains admission bills (with DRG, hospital number, and hospital characteristics) and associated physician bills (with RVUs, UPINs, and physician characteristics).

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[6] Medicare beneficiaries enrolled in HMOs are excluded from the analysis. Admission bills for these beneficiaries are reported in HCFA data systems, but most physician bills are not. Consequently, if HMO beneficiaries were left in the file, there would be a number of admissions with no physician services. Also, since beneficiaries cross state borders for various reasons (Miller and Welch 1992), any given state can include bills for a number of out-of-state Medicare beneficiaries. Our data includes only in-state admissions for state residents.

Although Medicare requires the reporting of UPINs, inevitably some records have invalid and missing UPINs. Invalid UPINs are those that do not meet the standard UPIN format (i.e., five digits preceded by an alpha character). Additionally, certain UPINs meeting the standard format were dropped because preliminary analyses showed them to be affiliated with an unreasonable number of hospitals.[7] Such a situation would arise where physicians or carriers were using a particular UPIN code as a "catch-all" UPIN. The seven-state data file includes 823 hospitals, 53,861 physicians, and about 640,000 admissions.

III. Medical Staff Affiliations

Previous research on physician affiliations with hospitals is now dated. Using American Medical Association (AMA) survey data, Musacchio et al. (1985) found that physicians had privileges at an average of 2.1 hospitals in 1982. Gaffney and Glandon (1982) report that in 1978, 89 percent of a physician's admissions were to a primary hospital. Finally, Custer and Willke (1991) report that in 1985 physicians in teaching hospitals had 2.2 hospital affiliations and admitted about 75 percent of their patients to a primary hospital. While pertinent, these studies are based on data that is nearly a decade old and physician affiliation patterns may have changed in the interim. Before we turn to our analysis of medical staff affiliations, it is important to discuss granting of medical staff privileges and the different types of privileges.

Granting Medical Staff Affiliations. In recent years, the granting of privileges by hospitals to physicians (referred to as credentialing) has come to be taken very seriously by hospitals.[8]

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[7] Ninety-nine percent of physicians have nine affiliations or fewer, thus valid UPINs with 10 affiliations or more (less than one percent of all physicians) were dropped from the file.

[8] This discussion is drawn from Nash, Mullaney, and Murphy (1991) and the 1991 JCAHO Hospital Accreditation Manual.

As a result of several court cases, hospitals are liable for the quality of care provided by the physicians on their staffs--legal precedent requires hospitals to not only screen credentials of potential candidates, but to periodically review these credentials. (Such credentialing requirements are codified by the Joint Commission on the Accreditation of Health Care Organizations [JCAHO], which defines criteria for the establishment and accreditation of hospital medical staffs). Beyond a more threatening liability environment, pressure to monitor privileges includes increasing numbers of practitioners and the rise in competition among hospitals. Competition among hospitals is expected to lead to more medical staff strategic planning and economic credentialing. The former refers to the selection of staff to maximize the provision of specific, financially favorable services the hospital wishes to provide, and the latter refers to selecting physicians that provide efficient care in general.

Types of Medical Staff Affiliations. Medical staff membership can be granted at different levels, for example, active, courtesy, and consulting (see Nash, Mullaney, and Murphy 1991 and JCAHO 1991 for a complete discussion). Although definitions vary from hospital to hospital, different levels of medical staff membership generally relate to greater degrees of organizational rights and responsibilities[9] and, more importantly, define a physician's admitting privileges. An active staff member may, within the constraints of occupancy and medical judgement, admit any patient. In contrast, a courtesy membership is often limited to a fixed number of admissions during the year. A consulting membership might be granted to a specialist who only provides consultations to attending physicians and who has no admitting privileges.

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[9] For example, an active member will have various committee responsibilities (e.g., utilization review), have to pay dues to the staff, and have to participate in decisions to grant new affiliations. Active membership might also entail accepting emergency calls and care for unassigned patients.

Whereas medical staff membership refers to the organizational relationship of the physician to the medical staff and his or her admitting privileges, "clinical privileges" govern what care the physician may provide in the hospital. That is, through clinical privileges, permission is granted by the hospital to perform specific diagnostic or therapeutic procedures or other patient care services within well defined limits based on the physician's license, training, experience, and competence. Clinical privileges are usually granted and reviewed by a specific specialty group within the staff. Thus, after being granted membership, the physician must establish competence in performing various procedures. A physician wishing to fully participate in the organizational decisions of the medical staff and practice a full range of medicine in the hospital would have to be granted active staff membership as well as clinical privileges across a range of services.

In contrast, a physician can be granted clinical privileges without medical staff membership. Under these circumstances, admission to the hospital would be made by a staff member. Furthermore, JCAHO guidelines require that a staff member be responsible for the general health of the patient.

The Number of Medical Staff Affiliations. We now calculate the number of medical staff affiliations physicians have using 100 percent Medicare claims data from seven states for the last six months of 1991. The number of affiliations for each physician (i.e., UPIN) is calculated as the number of different hospitals in which the physician has admissions in our database. Thus, we assume that physicians can only provide (and bill for) services during an admission in a hospital where they have an affiliation. Claims data, however, do not allow us to precisely determine the nature of a physician's affiliation. For example, we cannot distinguish between active and courtesy medical staff membership or between broad and limited clinical privileges.

Furthermore, the practice styles of certain specialties may necessarily involve few hospital admissions (e.g., a general practice physician may have few admissions). Including "nominal affiliation" physicians in our computations would tend to overstate the average number of affiliations.

To examine the potential impact of nominal affiliations, we examine the data under three assumptions--including all physicians in the file, excluding nominal affiliations, and focusing on attending physicians only. Table 1 reports the average number of affiliations under these three assumptions by four broad specialty groups.[10]

All physicians. The first column of Table 1 shows that among all physicians in our sample, the average number of affiliations is 2.25. This affiliation rate is consistent with that found in previous research noted above. Average affiliations are fairly consistent across these broad specialty categories ranging from 2.09 for surgeons and to 2.50 for medical specialists.

Excluding nominal affiliations. To explore the impact of removing nominal affiliations, we eliminated any observation from our data with less than 10 RVUs. The observations in our dataset and our nominal affiliation criteria require comment. Each physician (i.e., UPIN) can have affiliations in more than one hospital and consequently the unit of observation in our data set is the physician/hospital combination. If a given physician has two affiliations, one of which has less than 10 RVUs during our six month observation period, one observation would be dropped from the file. Obviously if a physician has only one affiliation in our file and the number of RVUs does not exceed the threshold, both the physician and the observation would be dropped from the file. The nominal affiliation threshold of 10 RVUs, may be best thought of in terms of actual services. For example, the physician must have provided, in a given hospital in the last six month period at least:

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[10] Medical specialties include: internal medicine, cardiology, gastroenterology, vascular disease, neurology, psychiatry, pulmonary disease, geriatrics, emergency medicine, oncology, and other medical specialty (e.g., allergy, obstetrics, gynecology, infectious disease, endocrinology). Surgical specialties include: general surgery, orthopedic surgery, thoracic surgery, urology, ophthalmology, cardiovascular surgery, and other surgical specialty (e.g., neurological surgery, oral surgery, plastic surgery). Other specialties includes: radiology, anesthesiology, and pathology, other physicians (e.g., chiropractor), and unreported (i.e., specialty not reported).

- three initial hospital care visits; or
- seven subsequent hospital care visits; or
- three initial inpatient consultations; or
- one appendectomy

to exceed the nominal affiliation threshold.

Eliminating observations with 10 RVUs or less in a given hospital results in a 17 percent reduction in the number of physicians but only a 1 percent reduction in RVUs (that is, eliminating nominal affiliations has a large impact on physicians but a nominal impact on services). Column two of Table 1 reports average affiliation by specialty under this assumption and we see that eliminating nominal affiliations has a substantial impact, reducing average affiliations from 2.25 to 1.65. Moreover there is some effect on affiliations by specialty. Medical specialties continue to have the most affiliations (1.84), but average affiliations for surgeons become nearly comparable (1.82). The general practice category now has the lowest average affiliation (1.39).

Attending physicians. In addition to identifying and eliminating nominal affiliations, one might be interested in the affiliation patterns of attending physicians. Limiting the physician universe to attending physicians (in addition to eliminating nominal affiliations) focuses the analysis of medical staff affiliations on those physicians that truly control hospital admission patterns and presumably manage care during the stay. Prior to any examination of the affiliation patterns of attending physicians, the attending physician must be identified. Since our claims data do not directly identify the attending physician,[11] we do so using the following rules:

- for medical admissions, the physician with the most hospital visit (including ICU visits) RVUs; and
- for surgical admissions, the physician providing the major surgery (i.e., that surgery with the highest RVUs).

Using these rules, 95.3 percent of admissions can be assigned an attending physician. Additionally, we applied the nominal affiliation rule (i.e., observations with less than 10 RVUs are dropped), which results in a total of 33,756 physicians and 589,151 admissions in 818 hospitals.[12] The precipitous drop in the number of physicians results from the designation of the attending status rather than the nominal affiliation rule.

Column three of Table 1 reports average affiliations for attending physicians and the mean affiliation of 1.55 is very close to the mean where nominal affiliations were removed (1.65). However, under this scenario, surgical specialties have the highest average affiliations (1.76). The "other" specialty category (as opposed to general practice) has the lowest average number of affiliations (1.26).

Summary. Thus, we find affiliation rates comparable to the literature when all physicians in our sample are included. Removing nominal affiliations results in an average affiliation rate of 1.65, markedly less than reported in the literature previously. Finally, attending physicians have an affiliation rate of 1.55.

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[11] The hospital admission included an "attending" physician field. However, UPIN reporting was not required until January 1, 1992.

[12] In addition, attending physician/hospital combinations with casemix-adjusted RVUs per admission greater than four times the national mean were dropped. This reduced the physician and admission counts by 164 (0.5 percent) and 638 (0.1 percent), respectively.

There are strong conceptual reasons to focus on attending physicians for the remainder of this analysis. First, one motivation for this analysis is to examine the potential for shifting admissions between staffs. It is the behavior of the attending physician that is critical to determining hospital admission patterns. Second, the behavior of the attending physician is crucial in determining the amount of resources provided to the patient during the admission.[13] Third, parts of the analysis to follow will focus on differences in practice styles between physicians with one affiliation versus those with many; in these instances the attending physician is the appropriate unit of analysis. Finally, a practical advantage of focusing on attending physicians is that affiliation rates are insensitive to whether or not nominal affiliations are included. In other words, focusing on attending physicians effectively eliminates nominal affiliations.

IV. Medical Staff Affiliations of Attending Physicians

We now turn to two basic analyses: average affiliation rates and the percentage of services provided in a single hospital. Given the policy relevance of having this information for all physicians as well as attending physicians, in the next section we will present these analyses for attending physicians in the body of the paper and for all physicians in Appendix B. Table 2 reports, by state, the number of attending physicians, admissions, and hospitals in the analysis file after restricting the sample to attending physicians and removing nominal affiliations.

To examine affiliation patterns by specialty, we define 22 specialty categories, most of which are self explanatory: general/family practice; internal medicine; cardiology;

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[13] An attending physician may not order each and every service provided during the admission, however, the attending physician decides which physicians are involved in the admission who, in turn, ultimately provide services to the patient.

gastroenterology; vascular disease; neurology; psychiatry; pulmonary disease; geriatrics; emergency medicine; oncology; other medical specialty (e.g., allergy, obstetrics, gynecology, infectious disease, endocrinology); general surgery; orthopedic surgery; thoracic surgery; urology; ophthalmology; cardiovascular surgery; other surgical specialty (e.g., neurological surgery, oral surgery, plastic surgery), radiology, anesthesiology, and pathology; other physician services (e.g., chiropractor); and unreported (i.e., specialty not reported).

Table 3 shows, as does Table 1, that the average attending physician has affiliations with 1.55 different medical staffs. Sixty-three percent of attending physicians are affiliated with only one hospital, and more than 96 percent of physicians have three affiliations or less. As might be expected, the surgical (1.76) and medical specialties (1.62) tend to have more affiliations than general/family practice (1.34). The "other" specialty category has fewer affiliations (1.26) than the general/family practice category, but recall that this category is dominated by RAPs and unreported specialty, both of which have very few affiliations (99.9 and 98.6 percent, respectively, have one affiliation).

Five medical specialties stand out as having high affiliation rates--cardiology (1.94), gastroenterology (1.88), vascular disease (2.17), pulmonary disease (2.05), and oncology (1.95). (It should be noted that there are only about 30 vascular disease specialists in our sample.) Similarly, three surgical specialties have relatively high average affiliations--thoracic surgery (2.20), urology (2.19), and cardiovascular surgery (2.08). Average affiliations do not appear to be driven by a few extreme cases. For example, among pulmonary disease specialists (approximately 500 physicians in our sample), 12 percent have four affiliations or more. Among thoracic surgeons (about 340 physicians in our sample), 14.5 percent have four affiliations or more. These eight specialties with higher than average affiliation rates, collectively accounting for 15 percent of all attending physicians but 24 percent of admissions.

Concentration of Services Across Hospitals. As discussed above, we measure physician resources provided during the admission using RVUs. We measure the concentration of an attending physician's services across hospitals by summing the attending physicians's RVUs for each hospital and dividing by the total RVUs for the attending physician.[14] For instance, for an attending physician who provided 30 RVUs in one hospital and 70 in another, Table 4 reports a 70 percent concentration figure. That is, 70 percent of services for this attending physician's services were provided in a single hospital, which is referred to as the "primary" hospital. Although we refer to the "attending physician's RVUs", recall that services provided by all physicians involved in the admission are assigned to a given attending physician.

Table 4 reports the proportion of RVUs provided in the attending physician's primary hospital affiliation. It appears that the overwhelming majority, 90 percent, of physicians' Medicare services are provided in a single hospital and the variation around this average is low (SD=.17). The median attending physician in this sample provides 100 percent of his or her services in a single hospital. Only about 3 percent of Medicare attending physicians provide less than 50 percent of their services in a single hospital.

These findings are generally consistent across specialty category, although surgical specialties as a group have somewhat lower service concentration (86 percent) than the general/family practice (93 percent), medical specialties (89 percent), and other specialties (94 percent). Service concentrations range from a low of 80 percent (vascular disease, urology) to a high of 99 percent (RAPs). The three highest services concentrations, not surprisingly, are found for RAPs (99 percent), psychiatry (97 percent), and emergency medicine (96 percent). Relatively lower service concentrations (ranging between 80 and 83 percent) are found for gastroenterology, vascular disease, pulmonary disease, thoracic surgery, and urology.

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[14] When admissions serve as the unit of the analysis, the results are nearly identical.

Another way to look at service concentration is the percentage of physicians with less than 50 percent of their services concentrated in a single hospital. Overall, 3.1 percent of Medicare attending physicians have service concentrations below 50 percent in a primary hospital. This figure is very low for general/family practice (1.3 percent) and "other" specialty (1.4 percent), somewhat higher for medical specialists (3.4 percent), and highest for surgical specialists (5.1 percent). Between 7 and 10 percent of physicians in gastroenterology, vascular disease, pulmonary disease, thoracic surgery, and urology have service concentrations of 50 percent or less.

Replicating the Analysis Using a National File. Our analysis of affiliation rates and service concentration is based on 1991 100 percent claims data for seven states. Beginning in 1992, hospitals were required to report the UPIN of the attending physician on the hospital admission bill. Recently the 1992 national Medicare Patient Analysis and Review (MedPAR) file, which contains 100 percent of Medicare admissions became available. Such a file allows us to replicate the basic affiliation and concentration analysis performed with the seven state file. The strength of the seven state file is that admissions are linked to physician bills rendering the RVUs for the admission (to be used for subsequent analyses). The strength of the MedPAR file is that it is national in scope and relatively easier to analyze (i.e., linking physician claims is unnecessary).

Replicating and comparing allows us to address two questions. The first, and most obvious, is whether drawing conclusions based on a seven state database are generalizable across the U.S. The second question is whether our methods of defining the attending physician are consistent with hospital's identification of the attending. Although we are unable to directly compare the two definitions of attending, we will present data suggesting that our methods of defining the attending are consistent with the identification of the attending by the hospital.

The analysis based on the MedPAR data differs from the seven state analysis is several ways. First, as mentioned, it pertains to all admissions in the country for 1992. Thus the national file represents 250,320 physicians and 5,309 hospitals, while the seven state analysis examined 33,756 physicians and 818 hospitals. Second, as mentioned, rather than defining attendings based on the services provided during the admission, the MedPAR file reports the attending's UPIN. Third, since RVUs have not been assigned, we are unable to apply the nominal affiliation rule. Thus the MedPAR analysis is based on all attendings--nominal affiliations have not been removed. Recall, however, that in the seven state file applying the nominal affiliation rule to attending physicians had very little impact. Finally, in computing the concentration of services we used RVUs in the seven state file. Again, because RVUs are not available in the national file, we use admissions.[15] That is, if a physician had a total of 100 admissions, 30 in one hospital and 70 in another, the concentration percentage for that physician would be 70 percent.

Appendix C compares analyses performed with the seven-state file and with the national MedPAR file. Overall, there is remarkable similarity in the results of the two analyses. Table C-1 reports average affiliations overall and by specialty. In both files attending physicians average one and a half affiliations (i.e., 1.55 seven state; 1.56 national) and 63 percent of physicians have one affiliation. Average affiliation rates by specialty are very similar between the two files.

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[15] Recall that the seven state file concentration analysis was performed using both admissions and RVUs--there was very little differences in the results.

Since this file is national in scope, it allows us to examine the difference in affiliation rates between urban and rural physicians. As discussed above, for each attending physician we calculated the percentage of admissions in each affiliation (i.e., hospital). That affiliation with a plurality of admissions was designated the "primary" affiliation. Based on the primary affiliation, we classified attending physicians into one of three geographic locations: large urban (>1 million population), other urban, and rural.[16]

We find that attending physicians average 1.27 affiliations in rural areas, 1.62 in other urban areas, and 1.63 in large urban areas. Thus, relative to the national average (1.56), rural physicians have markedly fewer affiliations but urban physicians are roughly at the national average. This is because the proportion of attending physicians located in rural areas is small (16 percent as compared with 40 and 44 percent in other urban and large urban areas, respectively).

Table C-2 compares average concentration of services overall and by specialty. Both files indicate that on average 90 percent (90 percent seven state; 91 percent national) of physicians' services are provided in a single, primary hospital. Again, the average concentrations by specialty are very similar.

Table C-3 compares the distribution of attending physicians between the two files. Again the two files produce remarkably similar results. The main difference between the two distributions appears to result from the large percentage of physicians (9.5 percent) with unreported specialty in the 1991 seven state file. In the 1992 national file all physicians were categorized by specialty. In appears the unreported physicians were often shifted to the "Other" categories. Although we cannot make direct statements regarding the comparability of the two methods of defining attendings, Table B-3 strongly suggests that the two definitions of attendings are comparable.

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[16] Bear in mind that a physician classified as "urban" based on the primary affiliation can have a second affiliation in a rural area and vice-versa.

Implications for Medical Staff Policy. The analyses presented thus far addresses two fundamental issues involving a medical staff policy. A high-cost medical staff policy could create incentives to direct admissions to one hospital versus another, potentially threatening the viability of hospitals. We have argued that unless physicians already have multiple affiliations, moving patients among hospitals will be difficult. As discussed, even without a policy change, the current (and future) environment is likely to make the acquisition of new affiliations more difficult. And although a high-cost medical staff policy could encourage individual physicians to try to obtain as many affiliations as possible, it creates an incentive for a medical staff to more carefully review the affiliations it grants. In sum, if physicians tend to have few affiliations and provide most of their services in a single hospital, the incentives of the policy would be more clearly focused and the threat of admission shift would be reduced.

Critical to the policy is the behavior of attending physicians--these physicians determine hospital admission patterns and, at least potentially, manage the physician resources provided during the stay.' We find that the average Medicare attending physician has very few affiliations--1.55, and that 63 percent have one affiliation. Additionally, we find that physicians provide the overwhelming majority (90 percent) of their services in a single, primary hospital. These two facts should allay fears that a medical staff policy would result in substantial patient shifting. We note however, there is some variation by specialty, with surgeons (a specialty closely tied to the hospital) having slightly higher average affiliations (1.76) and lower service concentrations (86 percent).

The medical staff proposal is designed to give physicians incentives to practice efficiently and we have argued elsewhere (Welch and Miller 1993) that to make the policy more effective physicians need information regarding their practices. Our research has developed inpatient physician service profiling tools (Welch, Miller, and Welch 1993). Using the same metric that the medical staff policy is based on, casemix-adjusted RVUs per admission, this tool could provide information at two important levels of aggregation. The first level of information would be by type of service--that is, how do medical staffs A and B compare regarding imaging services per admission or consultations per admission? Staffs A and B could be compared to national or state averages. The second level of aggregation is to provide individual attending physician practice profiles. That is, all services provided to a patient during the admission would be assigned to the attending and all attendings would be compared (to the national, state, specialty-specific, or medical staff averages).

This profiling information would help high-cost staffs in changing their practice styles. Physician practice profiles could potentially be one criterion for medical staffs to consider when granting privileges. For example, a medical staff considering a physician's privileges might request that physician's practice profiles for the last year. Although we have argued that the medical staff would have an incentive to carefully consider granting privileges, it is important to note competing incentives that might be present in the process. For example, a medical staff well below the high-cost threshold may be willing to accept the affiliation of a high-cost physician because of the physicians's reputation and the potential revenues. Hospitals with very low occupancy rates may be willing to accept high-cost physicians, effectively trading-off efficiency per admission for increased revenues.

V. The Relationship Between Affiliation Patterns, Casemix, and Practice Style

Primary Affiliation and Casemix. Whereas the above analysis pertained to concentration of services provided in a primary hospital (i.e., the hospital with the highest percentage of RVUs), Table 5 reports the primary affiliation by hospital type. There are no real surprises, the distribution of primary affiliations by hospital type generally follows the national distribution of Medicare admissions by hospital type (see Miller and Welch 1993b). For example, 84 percent of attending physicians have their primary affiliation in urban areas and 16 percent in rural areas--nationally, admissions are distributed 76 and 23 percent between urban and rural areas, respectively. About 77 percent of primary affiliations are with urban hospitals, about 62 percent are with nonteaching hospitals, and about 70 percent are with hospitals with 101-500 beds.

One issue regarding a physician's practice pattern pertains to a physician's decision to direct patients to specific hospitals, perhaps depending on the type of case. That is, do attending physicians tend to route their more complex cases (i.e., DRGs with higher weights) to one hospital versus another? Table 5 addresses this question by reporting average casemix at the primary hospital affiliation versus all other affiliations by hospital type.[17] Overall it would appear that there is only a small difference in Medicare patient mix between the attending physician's primary (1.11) and secondary (1.15) hospital affiliations. However, casemix is markedly lower in the primary affiliation when the attending physician's primary hospital is small

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[17] Casemix for an attending physician is computed as sum of the DRG weights divided by the sum of admissions. Casemix is computed separately for the primary affiliation and all other affiliations combined.

(200 beds or less), rural, and nonteaching. This might suggest that when attending physicians have primary affiliations with hospitals less oriented toward tertiary care, more complex cases are sent to the secondary affiliation (presumably a larger, urban, or teaching hospital). Additional support for this conclusion is found by examining major teaching hospitals, where casemix is higher when the primary affiliation is a major teaching hospital.

Table 6 examines casemix in the primary and secondary affiliation by specialty. General and family practice tend to have somewhat lower casemix in their primary affiliation (.70) as compared with their secondary affiliations (.79). The medical and surgical specialties as a group have similar casemix in their primary and secondary affiliations. However, certain medical and surgical specialties stand out as exceptions. Cardiology, vascular disease, emergency medicine, thoracic surgery, and cardiovascular surgery tend to have markedly higher casemix in their primary affiliation. In contrast, attending physicians classified as "other" surgical specialty tend to have higher casemix in their secondary affiliation. Finally, RAPs tend to have markedly higher casemix in their primary affiliation.

Multiple Affiliations, Physician Characteristics, and Practice Style. The next issue we take up is whether attending physicians with multiple affiliations differ substantially in terms of their characteristics and practice patterns. For example, are physicians with multiple affiliations younger (perhaps the process of building a practice involves multiple affiliations)? Do attending physicians with multiple affiliations provide more services per admission (perhaps because they have to involve more physicians in the admission and order more diagnostic testing)?[18]

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[18] Alternatively, assuming hospital-based care is a primary source of revenue, multiple affiliation physicians may have a greater incentive to provide more services.

Since most physicians have one affiliation, we divided attending physicians into two groups, those with one affiliation and those with multiple affiliations. Sixty-three percent (21,266) of attending physicians have one affiliation and 37 percent (12,490) were classified as having multiple affiliations.

Table 7 arrays these two groups of attending physicians on several demographic and practice style characteristics. There is no substantial difference in the average ages of these two groups (i.e., 45 years old). There are no striking differences between the two groups of physicians in terms of the medical school graduated from or Medicare participation. Multiple affiliation physicians appear to be somewhat more specialized than physicians with one affiliation. For example, 23 percent of one affiliation attending physicians are general practice as compared with 15 percent of multiple affiliation physicians. Twenty-nine percent of multiple affiliation attending physicians are surgical specialists as compared to 19 percent of single affiliation physicians.

Multiple affiliation physicians demonstrate some notable differences in practice patterns. By definition, services of attending physicians with multiple affiliations are much more diffused across hospitals--73 percent of their services are provided in their primary hospital as compared with 100 percent for physicians with one affiliation. Multiple affiliation attending physicians have markedly higher casemix overall (1.14) than those with one affiliation (1.08). (This is also true of their primary affiliations.) Given that multiple affiliation physicians are more highly specialized than their counterparts, it is not surprising to find that they have higher casemix. However, we find that the admissions of multiple affiliation physicians involve substantially more resources per admission than their counterparts, after adjusting for casemix. Multiple affiliation physicians average 44 casemix-adjusted RVUs per admission while attending physicians with one affiliation average 39 RVUs.[19]

In summary, multiple affiliation attending physicians appear to have more affiliations, in part, because of greater specialization. Certain specialties, particularly surgical specialties, are likely to be more dependent on maintaining several hospital affiliations. For the same reason it is not surprising to find that multiple affiliation physicians have higher casemix. However, after controlling for casemix, the admissions of multiple affiliation physicians involve 13 percent more resources per admission than their counterparts with one affiliation.[20] These results are graphically summarized in Figures 1 and 2.

One reaction to the practice findings might be that the specialty composition of multiple affiliation physicians accounts for the higher services per admission, even after casemix-adjusting. Table 7 also examines the relationship between affiliations, services per admission, and specialty.[21] We find that within the same specialty, multiple affiliation attending physicians tend to provide more services per admission, although the differences are often small. Interestingly, the largest differences are found for generalist categories (i.e., GP/FP, internist, general surgery). For example, multiple affiliation GP/FPs average 44 RVUs per admission as compared to 36 for GP/FPs with few affiliations. It may be that generalists who maintain multiple affiliations are spread too thin and need to involve more physicians in the admission, perhaps requiring more frequent diagnostic testing and consultations. RVUs per admission are between 11 and 15 percent higher for multiple affiliation internists, other medical specialists, general surgeons, and thoracic surgeons relative to their single affiliation counterparts.

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[19] Using the 1991 conversion factor of $31, multiple affiliation attending physicians average $1,364 per admission as compared with $1,209 for attendings with one affiliation.

[20] Our measure of casemix does not capture differences in severity within DRG.

[21] The number of attending physicians with multiple affiliations by specialty can be small; thus, we collapsed several specialty categories. All multiple affiliation specialty categories have 300 physicians or more except thoracic surgery (207).

VI. The Determinants of Hospital Medical Staff Practice Style

An issue related to practice style is whether a hospital medical staff is high cost in and of itself. That is, are the physicians who are high cost when practicing in one hospital, low cost when practicing elsewhere? Alternatively, high-cost hospitals might have physicians who are high cost wherever they practice. The first hypothesis could be true if a hospital has an expansive panel of high-technology equipment; or if the organizational culture of the hospital and its medical staff encourages a high-cost style of practice. The alternative hypothesis is that a hospital's medical staff is simply a collection of physicians whose training and practice style makes them high cost regardless of where they practice.

At least three implications might flow from an answer to this question: First, if one assumes that a medical staff policy would encourage physicians to shift their patients from high-cost hospitals to low-cost hospitals, this shifting would lower costs to the extent that the hospital, rather than the physician, was the dominant determinant of cost. Second, a medical staff's approach to controlling its costs could differ according to whether the problem was primarily at the hospital level or the physician level. If the former is true, a medical staff might most successfully respond with hospitalwide policies, such as choice of capital equipment and internal practice guidelines. Alternatively, if the latter is true, a medical staff might emphasize economic credentialing--the giving of staff privileges based, in part, on an efficient practice style. Third, information generated to support cost containment (e.g., physician profiling) might emphasize the hospital or the physician level depending on which had the dominant impact on practice patterns.

If the medical staff is the dominant determinant, profiling would emphasize the medical staff as the unit of analysis and vice-versa.

Methods.[22] This issue can be stated statistically as: Does the hospital or the physician explain the most variance in physician services per admission? Our dependent variable is casemix-adjusted RVUs per admission for a physician in a specific hospital.

Although we use analysis of variance (ANOVA) to determine how much of the variation is associated with the hospital and how much with the physician, its application to our database is not straightforward. The typical ANOVA application involves a balanced design. For physicians in hospitals, an example of a balanced design might be 100 physicians, each of whom practiced in each of three hospitals (in a small city). ANOVA would estimate three coefficients for the hospitals and 100 coefficients for the physicians.[23]

Because our data pertain to hospitals across several states (instead of limited to a single metropolitan area), the design is inherently unbalanced. Suppose we had data on a sufficient number of admissions for each physician in each of two hospitals to make a precise estimate of his/her volume. If there were 1000 physicians in 100 hospitals, this model would have 100,000 cells, the vast majority of which would be empty. The fact that the cells have different number of observations (typically zero) makes this model unbalanced.

In reality, our database has many physicians who practice in only one hospital (or perhaps have only a few admissions in a second hospital). To decrease the imprecision due to few admissions by one physician in one hospital, we retained only physicians who had at least 10 admissions in each of two (or more) hospitals. Because single-physician hospitals cannot help us disentangle the question of whether the hospital or the physician is the dominant factor, any hospital with only one physician in this restricted database was dropped. We iterated in such a manner until each physician appeared in at least two hospitals in the subsample and each hospital had at least two physicians in the subsample.

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[22] John Marcotte of the Urban Institute provided useful statistical advice.

[23] More precisely, avoiding the dummy variable trap, it would estimate one coefficient for the intercept, two for hospitals, and 99 for physicians.

As presented in Table 8, the subsample has 329 hospitals and 1889 physicians who practiced in more than one hospital. Fewer than 8 percent of these practiced in three or more hospitals (at least to the extent that our database had 10 or more admissions in any one hospital). This yielded 3920 physician-hospital combinations.[24]

Our subsample includes 88,828 admissions. On average, each hospital had 270 admissions, each physician had 47 admissions, and each affiliation had 23 admissions. This subsample represents a diversity of hospital types, including small hospitals and rural ones.

Results. As presented in Table 9, the hospital variables explain 39 percent of the variation in volume per admission for a physician in a specific hospital, whereas the physician variables explain 77 percent of the variance. The model for physicians has far more degrees of freedom than the model for hospitals. When degrees of freedom are adjusted for, the R-squares are 33 percent for hospitals and 55 percent for physicians. The practice style of individual physicians explains two-thirds more variance in services per admission than the practice style of the hospital medical staffs as units.

When both hospitals and physicians are included as explanatory variables, the adjusted R-square is .61. That is, if hospitals are entered first, adding physicians increases the adjusted R-square by about 27 percentage points (i.e., 60.6 - 33.4). If physicians are entered first, adding hospitals increases the adjusted R-square by about 5 percentage points (e.g., 60.6 - 55.3). We conclude that individual physicians are the dominant determinant of services per admission, although hospitals play a role too.

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[24] With SAS, we used the ANOVA procedure for a balanced design but general linear model (GLM) for an unbalanced design.

VII. The Concentration of Services Within Hospitals

The previous analysis established that it is predominantly the practice styles of individual physicians (rather than medical staff-level behavior) that determine whether a hospital medical staff is "high-cost" or not. This suggests that, under a medical staff policy, some of the initiatives to manage utilization should primarily focus on the practice styles of particular physicians. In this context, another relevant issue is the proportion of services accounted for by attending physicians on the medical staff. A medical staff policy is more likely to result in fewer services per admission if services are more concentrated among a few physicians. That is, if services are concentrated in the hands of a few physicians, peer pressure is more easily brought to bear. Alternatively, if services are more diffused across all physicians, changing behavior may be more difficult.

Table 10 reports the mean number of Medicare attending physicians per hospital by hospital type. The average hospital in our seven state sample has 64 attending physicians. Not surprisingly, the average number of attending physicians increases with bed size (e.g., 7 for <50 beds; 234 for >500 beds) and is larger in urban (e.g., 137 large urban; 18 rural), disproportionate share (90 versus 58) and teaching hospitals (e.g., 138 major teaching; 51 nonteaching). As a point of reference, Table 10 also reports the national average number of active and associate medical staff members reported by hospitals in the 1989 American Hospital Association (AHA)

Annual Survey. The average hospital had 117 active and associate medical staff members in 1989. The patterns by hospital type are consistent with our data. Our physician counts would be expected to be lower than the AHA counts because ours exclude nominal affiliations and focus on Medicare attending physicians.

Before moving to the measurement of the concentration of services within the hospital, it is important to distinguish between proportional concentration and absolute concentration. For example, assume a large and small hospital, the former with 100 physicians and the latter with 10 physicians. Further assume that in both hospitals 20 percent of the physicians account for the delivery of all services. Proportional concentrations in these hospitals would be equal--that is 20 percent of all physicians in each hospital account for all services. However, absolute concentrations in these two hospitals would be very different. In the larger hospital, all services would be accounted for by 20 physicians; whereas in the small hospital all services would be accounted for by two physicians.

We report two different measures of concentration--the Gini concentration ratio and the Herfindahl index. The properties of the former are such that if 20 percent of the physicians account for all the services in a hospital, the Gini ratio will be the same (0.80) regardless of the number of physicians on the staff. Alternatively, the Herfindahl index measures absolute concentration and in the example above would yield two different scores, 0.05 and 0.5 in the large and small hospital, respectively. Thus, for these two hospitals, the Gini ratio would produce the same score, indicating equal proportional concentration; whereas the Herfindahl index would produce two different scores, indicating lower absolute concentration in the larger hospital. We focus first on proportional concentration and then contrast proportional and absolute concentrations.

Table 11 reports the distribution of attending physicians and RVUs within the hospital by hospital type.[25] For each hospital, we calculated the percentage of total RVUs accounted for by each attending physician, which then were ordered from the lowest to the highest percentage of RVUs. Across all hospitals, 50 percent of attending physicians account for only 14 percent of services and 75 percent of physicians account for 38 percent of services. Most striking, the top 20 percent of attending physicians account for a majority (55 percent) of RVUs. Given an average of 64 attending physicians per hospital (Table 10), 13 attending physicians (i.e., the top 20 percent) account for a majority of all Medicare physician services delivered in the hospital. Relative to their counterparts, services are somewhat less (proportionally) concentrated in very small (50 beds or less) and rural hospitals, where the top 20 percent of attending physicians account for between 43 and 47 percent of services, respectively. Services in nonteaching hospitals are less concentrated than teaching hospitals--in nonteaching hospitals the top 20 percent of attending physicians account for 53 percent of services as compared with about 62 percent in teaching hospitals.

To summarize our data, we turn to the Gini concentration ratio and the Lorenz curve (Alker 1978; Morgan 1962). Although these measures are traditionally used to summarize the income distribution of a population, we use them to describe the distribution of RVUs. The Lorenz curve is a plot of the cumulative distribution of RVUs relative to the cumulative distribution of attending physicians. The latter graphically appears as 45 degree line; the cumulative plot of RVUs is the Lorenz curve. Recalling that attending physicians are ranked according to the percentage of RVUs accounted for, the distance between the Lorenz curve and the 45 degree line increases as concentration within the hospital increases.

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[25] Since we are interested in examining the distribution of services among the medical staff, the 11 hospitals with only one attending physician were removed from the analysis, resulting in a total of 807 hospitals.

Figure 3 is the Lorenz curve plot of RVUs for all hospitals (i.e., medical staffs) described above, and specifically indicates that the top 20 percent of attending physicians account for 55 percent of services. Figures 4-6 graphically underscore the points made above. Relative to their counterparts, the delivery of services is less concentrated in smaller (100 beds or less), rural, and nonteaching hospitals.

The Gini concentration ratio, which complements the Lorenz curve, is the ratio of the area between the Lorenz curve and the 45 degree line and the maximum possible area below the 45 degree line. Theoretically, the Gini ratio can vary from 0 (service distribution perfectly proportional) to 1 (service distribution perfectly disproportional). As mentioned, the Gini ratio measures proportional concentration, meaning the Gini ratio is comparable across medical staffs of different sizes.

Table 12 reports the Gini ratios by hospital type. Nationally, the Gini ratio is .52, with lower scores indicating less concentration. As above, services are more (proportionally) concentrated as the size of the hospital increases, with Gini ratios ranging from .40 in hospitals with 50 beds or less to .62 in hospitals with 500 beds or more. Similarly, services are more concentrated in urban versus rural area hospitals (i.e., .45 rural, .58 other urban, and .50 large urban) and in teaching versus nonteaching hospitals (.51 nonteaching, .60 minor teaching, and .59 major teaching).

Obviously, the variability in service concentration can be greater when one considers individual hospitals. Figure 7 displays the Lorenz curve and Gini ratio for two urban, nonteaching, nondisproportionate share hospitals. RVUs are proportionally less concentrated in hospital A (Gini=.36) than in hospital B (Gini=.74). In hospital A the top 20 percent of attending physicians account for 42 percent of services whereas in hospital B the top 20 percent account for 80 percent of services.

Proportional Concentration Versus Absolute Concentration. The Herfindahl index scores in Table 12 suggest a very different picture than that provided by the Gini ratio. Although larger, urban, disproportionate share, and teaching hospitals are proportionally more concentrated (using the Gini ratio), due to their larger staff sizes, the Herfindahl index shows lower absolute service concentrations in these hospitals. The Herfindahl index is .14 for all hospitals and falls (indicating less absolute concentration) as bed size increases (e.g., .34 for <50 beds; .02 for >500 beds). The Herfindahl index indicates lower absolute service concentrations in: urban versus rural (e.g., .04 large urban; .23 rural), disproportionate share versus nondisproportionate share (.09 and .15, respectively), and teaching versus nonteaching (e.g., .04 major teaching; .16 nonteaching).

The different properties of these measures raise an important policy point. We have argued above that a medical staff policy is more likely to control volume in a hospital where services are more concentrated. That is, if a hospital medical staff is high cost and must change its behavior to maintain its fees, it is easier to change the behavior of a few key physicians than for all physicians on the staff to change behavior. The Gini ratio suggests that the policy will have greater impact on larger, urban, and teaching staff where proportional concentration is greater. On the other hand, the Herfindahl index reminds us that these staffs are larger and, therefore, in absolute terms, services are dispersed across more attending physicians.

Even in terms of absolute concentration, the numbers of physicians are not overwhelming. For example, in large urban area hospitals, an average of only 27 physicians (the top 20 percent) account for 62 percent of services. In major teaching hospitals, about 28 physicians account for 63 percent of all services. By way of contrast, in nonteaching hospitals an average of 10 physicians account for 53 percent of all services.

VIII. Conclusions and Policy Implications

A medical staff policy would put the medical staff of a hospital at risk for the inpatient services they deliver. That is, medical staffs that deliver substantially more services per admission than other staffs, after controlling for patient mix, would be penalized through fee reductions. Some have raised concerns that such a policy would encourage physicians to shift admissions between hospitals in a effort to thwart the policy incentives and to obtain the most advantageous payment. In principle, such behavior could threaten the viability of certain high-cost hospitals as physicians move admissions (perhaps both Medicare and non-Medicare admissions) to other hospitals. The ability to easily shift admission depends in part on the number of hospitals a physician is affiliated with--the fewer affiliations, the less probable the shifting. Moreover, there are reasons to believe that acquiring new affiliations in the future will be more rather than less difficult. Changes in reimbursement practices and liability have resulted in a trend toward hospitals consolidating and more closely monitoring staff affiliations. A medical staff policy would reinforce these trends.

We have investigated three questions crucial to the policy. First, how many affiliations do physicians have? Second, what percentage of their services are provided in a single, primary hospital? Third, within the hospital, are services concentrated in the hands of a few physicians? It is important to reiterate that it is the behavior of the attending physician that is most critical to the policy because they determine admission patterns and are at least potentially responsible if not currently accountable for the care provided during the hospital stay.

We find that the average attending physician has few (1.55) affiliations and that the overwhelming majority of services are provided in a single, primary hospital (90 percent). These results should allay fears that a medical staff policy will result in substantial shifting of admissions between hospitals. Physicians are currently oriented toward practicing in one hospital and do not have multiple affiliations suggesting that large-scale admission shifting in the short run is unlikely.[27] (Even if all physicians are considered, average affiliations are 2.25 and 88 percent of services are provided in a single, primary hospital.)

We also find that in the typical hospital about 20 percent of attending physicians account for 55 percent of Medicare inpatient physician services. For the average medical staff this means that only about 13 physicians are potentially responsible for managing the majority of Medicare physicians services. This suggests that medical staffs could focus on a relatively small number of attending physicians to successfully effect change in the performance of the staff as a whole. We would point out that even if the percentage of attending physicians accounting for a majority of services is relatively small (e.g., 20 percent), the number of physicians can be significant. Thus in major teaching hospitals 63 percent of services are accounted for by 20 percent of physicians (i.e., an average of 28 physicians). Moreover, it is important to bear in mind that these figures refer to the attending physician. Several physicians can be involved in the admission. For these 20 percent of attending physicians to control 55 percent of services, they would have to change the behavior of all physicians involved in their admissions or involve fewer physicians in the admission.

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[27] Furthermore, since Medicare generally represents only a third of all admissions, physicians may not have a strong incentive to engage in admission shifting.

The concentration of services in the hospital is particularly relevant. One might hypothesize that hospital medical staffs develop an organizational culture that encourages aggressive treatment and that this practice style may be encouraged by the presence of high technology. However, it is the practice styles of individual physicians, as opposed to the practice style of the staff as a whole, that largely determines whether a given hospital is high-cost or not. That is, high-cost physicians appear to be high-cost regardless of the hospital in which they are practicing at the moment. This suggests that a major focus of medical staffs would need to be the practice styles of individual physicians.[28] The fact that a relatively few attending physicians control most services suggests that "physician profiling" could potentially (or perhaps initially) focus on the practice patterns of these physicians (Welch, Miller, and Welch 1993).[29]

Our analysis of differences between attending physicians with one versus multiple affiliations indicates that multiple affiliation physicians are more specialized. More importantly, multiple affiliation physicians provide 13 percent more services per admission, after controlling for patient mix. This result is generally true for several specialties when comparisons are made by specialty. Coupled with the dominance of individual practice styles, a medical staff policy would appear to give staffs a strong incentive to discourage multiple affiliations.

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[28] It should be noted that the practice style of the medical staff as a whole does have some impact on the medical staffs overall services per admission. Consequently, medical staffs will also have to focus on decisions, such as the purchase of new technologies, that could influence the practice pattern of the staff as a whole.

[29] A staff may still be interested in profiling all physicians. An attending physician who routinely involves other physicians in his/her admissions, will need to understand the practice patterns of those physicians in order to change the amount of resources provided.

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Table 1
Physician Affiliations by Specialty Under Various Assumptions

Specialty	All Physicians	All Physicians (Nominal Affiliations Removed)[1]	Attending Physicians (Nominal Affiliations Removed)[2]
Total	2.25	1.65	1.55
General Practice	2.15	1.39	1.34
Medical Specialty	2.50	1.84	1.62
Surgical Specialty	2.09	1.82	1.76
Other Specialty	2.10	1.42	1.26
Number of Physicians	53,861	44,802	33,756

[1] Physician/hospital combinations with less than 10 RVUs removed.

[2] Physician/hospital combinations with less than 10 RVUs and attending physicians with casemix-adjusted RVUs per admission greater than four times the national mean (i.e., 0.1 percent of admissions) have been removed.

Source: 1991 NCHS File--100 percent claims for seven states.

Table 2
Number of Observations
Attending Physician Analysis File
by State

	Physicians	Admissions	Hospitals
Total	33,756	589,151	818
Alabama	3,297	90,461	116
Florida	12,512	221,255	220
Indiana	4,763	91,089	115
Kansas	2,004	43,666	129
Missouri	7,562	98,227	134
Oregon	2,517	31,958	66
Utah	1,101	12,495	38

Source: 1991 NCHS File--100 percent claims for seven states.

Table 3
Attending Physician Hospital Affiliations by Specialty

Physician Specialty	Mean	Standard Deviation	% of Physicians by Number of Affiliiation				Min	Max	% of Physicians	% of Admissions
			1	2-3	4-6	7-9				
All	1.55	0.87	62.8	33.6	3.5	0.1	1	9	100.0	100.0
GP/FP	1.34	0.64	72.8	26.3	0.9	0.1	1	9	20.1	19.9
Medical Specialty	1.62	0.91	58.8	36.9	4.2	0.1	1	9	43.9	50.3
Internal Medicine	1.63	0.90	57.0	39.1	3.8	0.1	1	9	18.3	28.2
Cardiology	1.94	1.04	42.9	48.9	8.1	0.1	1	7	5.3	9.5
Gastroenterology	1.88	1.01	43.8	49.0	7.2	0.0	1	6	2.1	1.6
Vascular Disease	2.17	1.11	34.8	47.8	17.4	0.0	1	4	0.1	0.1
Neurology	1.60	0.80	56.1	41.3	2.6	0.0	1	5	2.4	1.2
Psychiatry	1.13	0.37	88.9	11.1	0.0	0.0	1	3	1.6	0.5
Pulmonary Disease	2.05	1.23	41.4	46.8	11.2	0.6	1	8	1.6	2.6
Geriatrics	1.62	0.68	48.9	51.1	0.0	0.0	1	3	0.1	0.2
Emergency Medicine	1.14	0.38	87.0	13.0	0.0	0.0	1	3	0.5	0.2
Oncology	1.95	1.08	44.8	45.6	9.4	0.2	1	7	1.2	1.9
Other Medical	1.39	0.75	71.7	26.3	1.9	0.1	1	8	10.8	4.3
Surgical Specialty	1.76	1.02	52.2	41.7	5.9	0.3	1	9	22.8	25.4
General Surgery	1.74	0.97	51.7	42.7	5.4	0.2	1	7	7.4	9.9
Orthopedic Surgery	1.70	0.89	51.4	44.6	3.9	0.1	1	7	6.0	5.5

Table 3
Attending Physician Hospital Affiliations by Specialty
(con't)

Physician Specialty	Mean	Standard Deviation	% of Physicians by Number of Affiliiation 1	2-3	4-6	7-9	Min	Max	% of Physicians	% of Admissions
Thoracic Surgery	2.20	1.47	39.8	45.6	12.5	2.0	1	9	1.0	1.9
Urology	2.19	1.20	33.4	52.9	13.3	0.4	1	9	3.2	4.8
Ophthalmology	1.16	0.40	85.5	14.5	0.0	0.0	1	3	1.6	0.4
Cardiovascular Surgery	2.08	1.29	42.9	43.4	12.1	1.5	1	8	0.6	1.3
Other Surgical	1.52	0.83	63.4	33.6	2.8	0.2	1	8	3.0	1.7
Other	1.26	0.59	79.1	19.8	1.0	0.1	1	7	13.1	4.3
RAPs	1.05	0.25	95.8	4.1	0.1	0.0	1	4	2.8	0.5
Other Physicians	1.21	0.48	81.5	18.1	0.4	0.0	1	4	0.8	0.3
Unreported	1.33	0.65	73.9	24.6	1.4	0.1	1	7	9.5	3.5

N = 33,756.

Source: 1991 NCHS File--100 percent claims for seven states.

Table 4
Percentage of Attending Physician RVUs in a Single Hospital by Specialty

Physician Specialty	Mean	Standard Deviation	Median	Percent of Physicians with less than 50%	Min	Max	Percent of Physicians
All	.90	.17	1.00	3.1	.20	1.00	100.0
GP/FP	.93	.14	1.00	1.3	.23	1.00	20.1
Medical Specialty	.89	.17	1.00	3.4	.22	1.00	43.9
Internal Medicine	.89	.17	1.00	3.1	.22	1.00	18.3
Cardiology	.86	.18	0.96	4.9	.29	1.00	5.3
Gastroenterology	.83	.19	0.92	6.9	.35	1.00	2.1
Vascular Disease	.80	.20	0.82	8.7	.41	1.00	0.1
Neurology	.88	.17	1.00	2.8	.31	1.00	2.4
Psychiatry	.97	.10	1.00	0.6	.38	1.00	1.6
Pulmonary Disease	.83	.20	0.95	8.2	.23	1.00	1.6
Geriatrics	.91	.15	1.00	4.4	.39	1.00	0.1
Emergency Medicine	.96	.10	1.00	0.0	.55	1.00	0.5
Oncology	.84	.19	.93	5.5	.30	1.00	1.2
Other Medical	.91	.16	1.00	2.4	.24	1.00	10.8
Surgical Specialty	.86	.19	1.00	5.1	.20	1.00	22.8
General Surgery	.87	.18	1.00	3.6	.25	1.00	7.4
Orthopedic Surgery	.86	.19	1.00	5.3	.27	1.00	6.0
Thoracic Surgery	.83	.21	.93	9.0	.20	1.00	1.0

Table 4
Percentage of Attending Physician RVUs in a Single Hospital by Specialty

Physician Specialty	Mean	Standard Deviation	Median	Percent of Physicians with less than 50%	Min	Max	Percent of Physicians
Urology	.80	.20	.84	10.6	.25	1.00	3.2
Ophthalmology	.96	.12	1.00	0.2	.43	1.00	1.6
Cardiovascular Surgery	.86	.18	.97	3.5	.35	1.00	0.6
Other Surgical	.90	.17	1.00	3.7	.30	1.00	3.0
Other	.94	.14	1.00	1.4	.28	1.00	13.1
RAPs	.99	.07	1.00	0.3	.45	1.00	2.8
Other Physicians	.95	.13	1.00	0.0	.50	1.00	0.8
Unreported	.92	.15	1.00	1.9	.28	1.00	9.5

N = 33,756.

Source: 1991 NCHS File--100 percent claims for seven states.

Table 5
Primary Affiliation of Attending Physician by Hospital Type

Hospital Type	Attending Physicians		Casemix	
	Number	Percent	Primary	Other
All Hospitals	32,847	100.00	1.11	1.15
Bedsize				
<50 Beds	889	2.7	0.75	1.18
51-100 Beds	2,562	7.8	0.87	1.15
101-200 Beds	5,954	18.1	1.02	1.11
201-300 Beds	6,288	19.1	1.13	1.11
301-500 Beds	10,351	31.5	1.17	1.15
500+ Beds	6,803	20.7	1.24	1.21
Disproportionate Share				
No	23,659	72.0	1.11	1.15
Yes	9,188	28.0	1.12	1.14
Urban/Rural				
Rural	5,311	16.2	0.92	1.17
Small Urban	17,838	54.3	1.16	1.18
Large Urban	9,698	29.5	1.14	1.09
Teaching				
Nonteaching	20,496	62.4	1.07	1.13
Minor Teaching	9,948	30.3	1.18	1.19
Major Teaching	2,403	7.3	1.24	1.12

Note, for 909 attending physicians, hospital characteristics could not be identified.

Source: 1991 NCHS File--100 percent claims for seven states.

Table 6
Attending Physician Casemix[1] in the Primary and Other Affiliations by Specialty

Specialty	Affiliation Primary	 Other
All Physicians	**1.11**	**1.15**
GP/FP	**.70**	**.79**
Medical Specialty	**.93**	**.92**
Internists	.74	.79
Cardiology	1.22	1.14
Gastroenterology	.93	.92
Vascular Disease	2.22	2.06
Neurology	0.82	0.83
Psychiatry	.69	.70
Pulmonary Disease	.83	.84
Geriatrics	.70	.76
Emergency Medicine	.95	.76
Oncology	.66	.67
Other Medical Specialty	1.21	1.17
Surgical Specialty	**1.71**	**1.71**
General Surgery	1.63	1.67
Orthopedic Surgery	1.66	1.67
Thoracic Surgery	3.19	2.88
Urology	1.28	1.24
Opthalmology	1.42	1.47
Cardiovascular Surgery	3.43	2.83
Other Surgical Specialty	1.80	1.92
Other	**1.31**	**1.11**
RAPs	1.97	1.38
Other Physicians	1.28	1.33
Unreported	1.12	1.08

N = 33,756.

[1] Casemix for an attending physician is computed as the sum of the DRG weights divided by the sum of admissions. Casemix is computed separately for the primary affiliation and all other affiliations combined.

Source: 1991 NCHS File--100 percent claims for seven states.

Table 7
Comparison of Attending Physician Characteristics and Practice Style by Number of Affiliations

	Affiliations	
	1	2 or more
All Physicians	63%	37%
Physician Characteristics		
Age		
Mean	45	45
Less than 35	17%	14%
35-44	40%	44%
45-54	24%	27%
55-64	14%	12%
Greater than 64	5%	3%
Medical School		
Foreign Medical Graduate	12%	18%
In-state U.S. Graduate	28%	24%
Out-of-state U.S. Graduate	60%	58%
Medicare Participation	52%	54%
Group Practice	57%	55%
Specialty		
General Practice[1]	23%	15%
Medical Specialty	41%	49%
Surgical Specialty	19%	29%
Other Specialty	17%	7%
Practice Style		
Affiliation Concentration	100%	73%
Average Casemix All Hospitals	0.98	1.04
Average Casemix in Primary Affiliation	0.98	1.06
Casemix-Adjusted RVUs per Admission		
All Physicians	39	44
General Practice	36	44
Medical Specialty		
Internal Medicine	41	47
Cardiology	42	45
Gastroenterology	46	47
Other Medical	41	46
Surgical Specialty		
General Surgery	35	39
Orthopedic Surgery	39	40
Thoracic Surgery	36	40
Urology	38	40
Other Surgical Specialty	40	41

N = 33,756.

[1] General Practice includes general and family practice. Internal medicine is included in medical specialty.

Source: 1991 NCHS File--100 percent claims for seven states.

Table 8
Characteristics of ANOVA Subsample

	Number of Observations	Range		Admissions per Unit	
		Physicians*	Hospitals**	Mean	Range
Hospitals	329	2-68	NA	270	20-1823
Individual Physicians	1889	NA	2-4	47	20-239
Physician-Hospital Combinations	3920	NA	NA	23	10-177

* Number of physicians practicing in a specific hospital.
** Number of hospitals that a specific physician is affiliated with.
Source: 1991 NCHS File--subsample 100 percent claims for seven states.

Table 9
ANOVA of Physicians and Hospitals

Independent Variables	Design	R-square	Adjusted R-square	F-value	Degrees of Freedom in the Model
Hospitals	Balanced	.390	.334	6.99*	328
Individual Physicians	Balanced	.769	.553	3.57*	1,888
Hospitals and Physicians	Unbalanced	.823	.606	3.80*	2,156

Note: The dependent variable is the volume per admission for a physician in a specific hospital.

* Significant at 1 percent.

N = 3,920

Source: 1991 NCHS File--subsample 100 percent claims for seven states.

Table 10
Mean Number of Attending Physicians and Medical Staff Members by Hospital Type

	Mean Number of Medicare Attending Physicians (7 state sample)	Mean Number of Active and Associate Medical Staff Members (1989 AHA National Survey)
All	64	117
Bedsize		
<50	7	13
50-100	19	35
101-200	54	94
201-300	113	185
300-500	157	287
500+	234	509
Location		
Rural	18	27
Other Urban	95	158
Large Urban	137	241
Disproportionate Share		
No	58	90
Yes	90	189
Teaching Status		
Nonteaching	51	69
Minor Teaching	132	235
Major Teaching	138	486

Table 11
Distribution of RVUs by Percentage of Attending Physicians

	Percentage of Attending Physicians												
	10%	20%	30%	40%	50%	60%	70%	75%	80%	85%	90%	95%	100%
All	0.01	0.02	0.05	0.09	0.14	0.21	0.32	0.38	0.46	0.55	0.65	0.79	1.00
Bedsize													
<50	0.02	0.05	0.09	0.14	0.21	0.30	0.42	0.49	0.57	0.67	0.77	0.88	1.00
50-100	0.01	0.03	0.06	0.10	0.16	0.24	0.35	0.42	0.50	0.59	0.70	0.83	1.00
101-200	0.01	0.02	0.04	0.07	0.12	0.19	0.28	0.35	0.42	0.51	0.62	0.77	1.00
201-300	0.01	0.02	0.03	0.06	0.11	0.17	0.26	0.32	0.39	0.48	0.58	0.73	1.00
301-500	0.00	0.01	0.03	0.06	0.10	0.16	0.24	0.30	0.37	0.46	0.57	0.71	1.00
500+	0.00	0.01	0.03	0.06	0.10	0.15	0.24	0.29	0.36	0.45	0.55	0.70	1.00
Location													
Rural	0.01	0.03	0.07	0.11	0.17	0.26	0.37	0.44	0.53	0.62	0.72	0.85	1.00
Other Urban	0.01	0.02	0.04	0.06	0.11	0.17	0.27	0.33	0.40	0.49	0.60	0.75	1.00
Large Urban	0.01	0.02	0.04	0.06	0.11	0.17	0.25	0.31	0.38	0.46	0.57	0.72	1.00
Disproportionate Share													
No	0.01	0.03	0.05	0.09	0.14	0.22	0.32	0.39	0.47	0.56	0.67	0.80	1.00
Yes	0.01	0.02	0.04	0.07	0.12	0.19	0.28	0.34	0.42	0.51	0.62	0.76	1.00
Teaching Status													
Nonteaching	0.01	0.03	0.05	0.09	0.15	0.22	0.33	0.40	0.47	0.56	0.67	0.81	1.00
Minor Teaching	0.01	0.02	0.03	0.06	0.10	0.16	0.25	0.31	0.38	0.47	0.58	0.72	1.00
Major Teaching	0.01	0.02	0.03	0.06	0.11	0.16	0.25	0.31	0.37	0.46	0.57	0.73	1.00

N = 32,847.
Source: 1991 NCHS File--100 percent claims for seven states.

Table 12
Gini Concentration Ratio and Herfindahl Index
by Hospital Type

	Gini	Herfindahl	% of RVUs Accounted for by the Top 20% of Attending Physicians	Mean Number of Medicare Attending Physicians	Number of Hospitals
All	0.52	0.14	54%	64	807
Bedsize					
<50	0.40	0.34	43	7	159
50-100	0.48	0.18	50	19	199
101-200	0.56	0.07	58	54	189
201-300	0.59	0.03	61	113	92
300-500	0.61	0.02	63	157	99
500+	0.61	0.02	64	234	40
Location					
Rural	0.45	0.23	47	18	372
Other Urban	0.58	0.06	60	95	284
Large Urban	0.60	0.04	62	137	122
Disproportionate Share					
No	0.51	0.15	53	58	616
Yes	0.56	0.09	58	90	162
Teaching Status					
Nonteaching	0.50	0.16	53	51	645
Minor Teaching	0.60	0.05	62	132	113
Major Teaching	0.59	0.04	63	138	20

N = 32,847.
Source: 1991 NCHS File--100 percent claims for seven states.

Figure 1
Attending Physician Characteristics
by Number of Affiliations

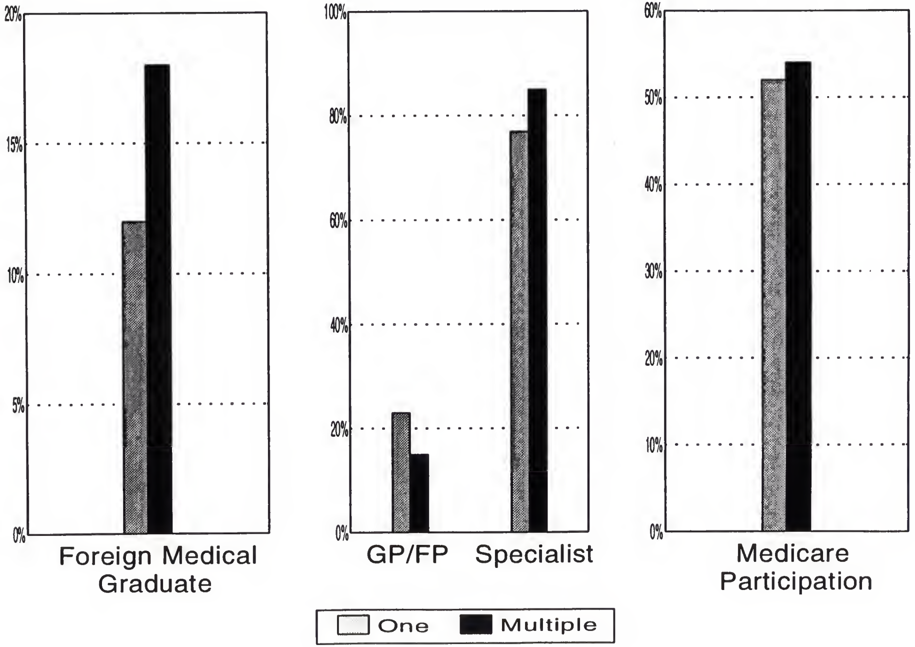

Figure 2
Attending Physician Characteristics
by Number of Affiliations

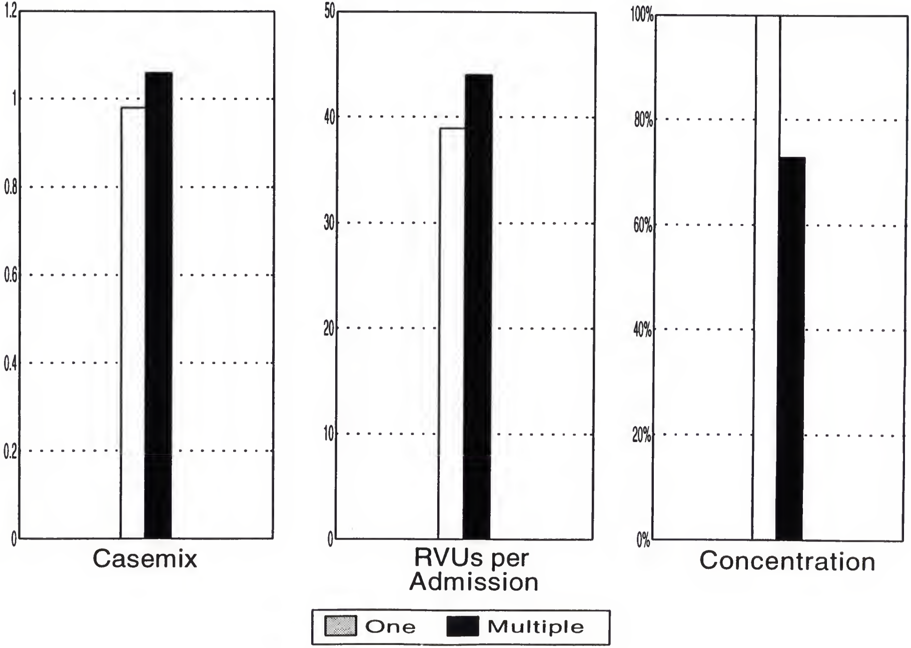

Figure 3
Distribution of RVUs
by Percentage of Attending Physicians

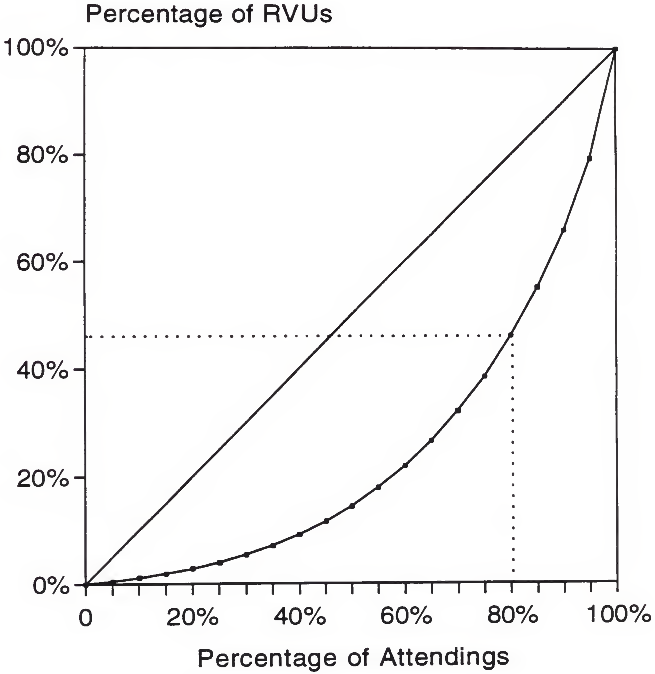

Figure 4
Distribution of RVUs by Percentage of Attending Physicians
Bedsize

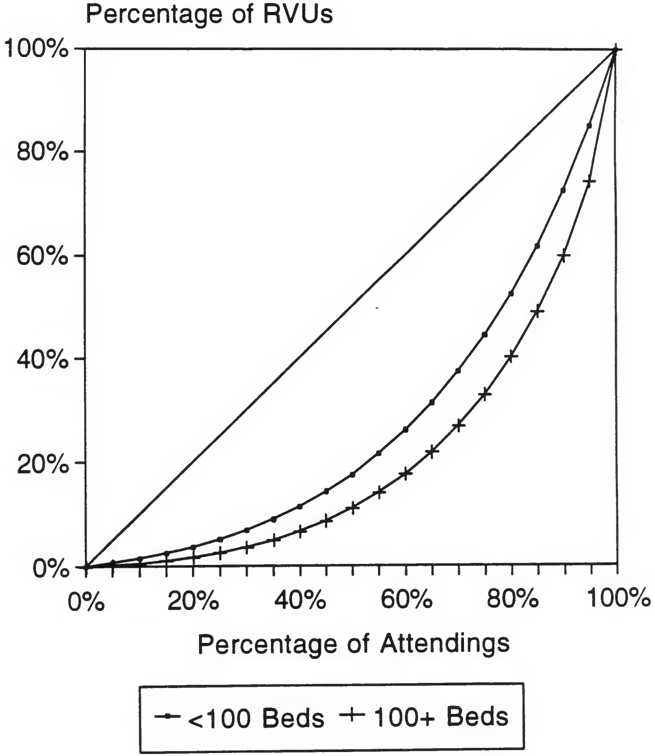

Figure 5
Distribution of RVUs by Percentage of Attending Physicians Urban/Rural Location

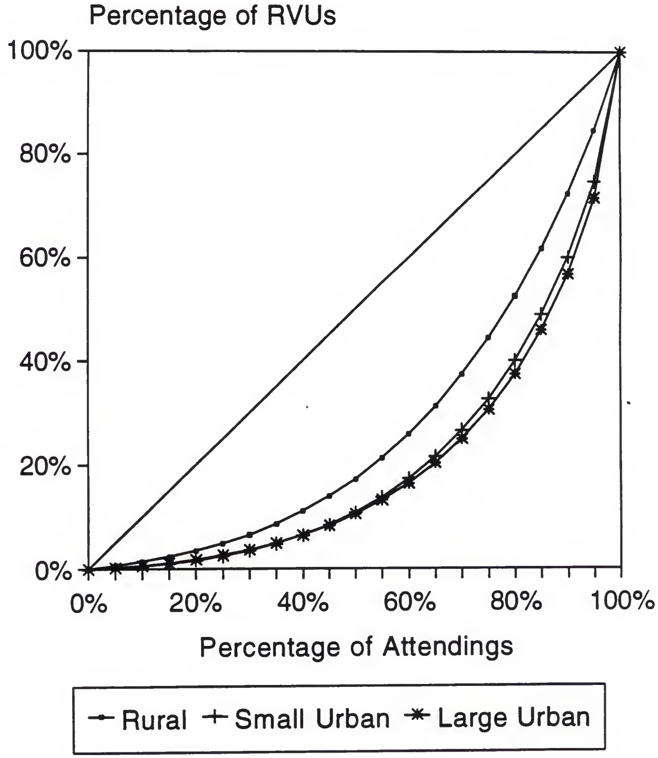

Figure 6
Distribution of RVUs by Percentage of Attending Physicians Teaching Status

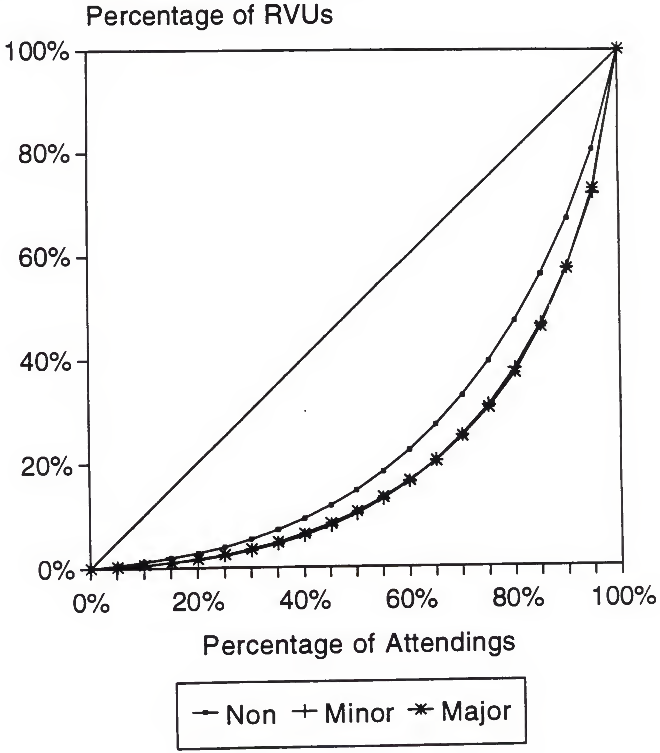

Figure 7
Distribution of RVUs by Percentage of Attending Physicians in Two Selected Hospitals

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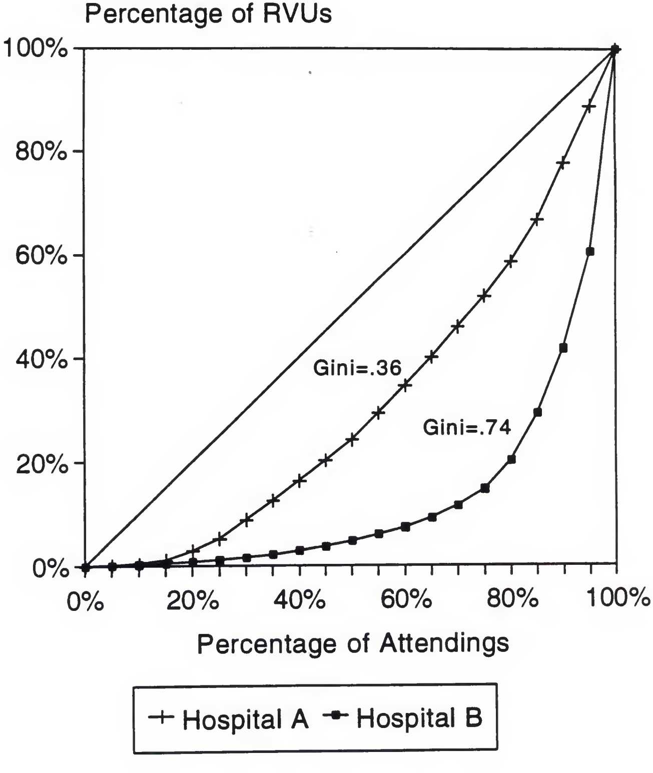

Appendix A

Services Provided by Nonstaff Physicians in Windows

A high-cost medical staff policy is intended to provide an incentive for physicians to control the volume of services they provide to Medicare patients. However, if the policy covers only inpatient services provided during the hospital stay, physicians may shift some services to shortly before or after the stay, diluting the impact of the policy. Therefore, putting physicians at risk for services provided in "windows" around a hospital stay may be an important component of the policy. On the other hand, physicians who are not a part of the medical staff may deliver services in the windows. A staff may have no formal structure to influence the behavior of nonstaff physicians, so that making a staff responsible for these services might be considered unfair. Hence, it is important to assess the extent to which services provided in windows around an inpatient stay are provided by nonstaff physicians.

To calculate staff and nonstaff services, we assumed that any physician billing for inpatient services in a hospital is part of its medical staff. Then for each hospital we summed the RVUs for physician services provided during the stay and services provided in 28-day windows around the stay. Additionally, we summed the RVUs in the windows billed by staff physicians only.

On average for hospitals in our sample, 22 percent of services in a 28-day pre- and post-window were provided by nonstaff physicians. This is somewhat less than we found in an earlier report using a national 5-percent sample,[1] where 29 percent of charges in a 28-day window were provided by nonstaff physicians.

Our current results benefit from three methodological improvements. First, the current results benefit from the use of UPINs. In the previous study, physicians might have had several identifiers or a group practice might have had one identifier for several physicians. Additionally, the previous results were based on a national 5-percent sample of Medicare beneficiaries, while the current results reflect a seven state 100-percent sample. Using a 100-percent sample increases the likelihood that we will identify all physicians who are part of the medical staff. Lastly, in contrast to the use of charges in the previous work, the current results are based on RVUs, which represent a more direct measure of physician service volume and intensity.

Table A-1 displays the percentage of nonstaff physician services by hospital type and state. There is some variation across hospital types. More of the services provided in the windows are attributable to nonstaff physicians in small (100 beds or less) and rural hospitals (at least 27 percent). In major teaching hospitals 26 percent of the services are attributable to nonstaff physicians. In contrast, no more than 16 percent of services in the windows in minor teaching and large hospitals (those with greater than 200 beds) are provided by nonstaff physicians. By state, the percentage of services to nonstaff physicians ranges from 26 percent in Kansas to 19 percent in Florida.

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[1] Miller and Welch (1991) "Hospital Medical Staffs and Medicare Volume Performance Standards: Analytic Foundations," Urban Institute Working Paper 3982-01, December 1991

Describing nonstaff window services as a proportion of total window services may exaggerate the impact of these services on a medical staff policy. Nonstaff services makeup a much smaller percentage of physician services during the episode (those services during the stay and in the windows), with nonstaff services representing on average less than 6 percent of episode services. Additionally, as our previous research described, if the number of days in the window are decreased (from 28 days to, say, 14 or 7 days), fewer episode services are provided in the windows and the proportion of episode services provided by nonstaff physicians decreases dramatically.

Table A-1
Percentage of Nonstaff Physician Services Delivered in Windows by Hospital Type

Hospital Type	Number of Hospitals	% of Window Services to Nonstaff Physicians
All Hospitals	777	22
Bedsize		
Less than 50	160	32
51-100	199	27
101-200	189	19
201-300	90	14
301-500	99	14
Greater than 500	40	14
Location		
Large Urban	120	20
Other Urban	284	17
Rural	373	27
Disproportionate Share Status		
Non-Disproportionate Share	615	23
Disproportionate Share	162	20
Teaching Status		
Nonteaching	644	23
Minor Teaching	113	16
Major Teaching	20	26
State		
Alabama	111	24
Florida	207	19
Indiana	110	21
Kansas	123	26
Missouri	129	22
Oregon	64	24
Utah	33	23

Source: 1991 NCHS File--100 percent claims for seven states; Values are not weighted by admissions.

Appendix B

Average Affiliations and Concentration by Specialty All Physicians

Our analysis focuses on the attending physician because these physicians drive admission patterns and are (presumably) responsible for care provided during the hospital stay. Nonetheless, policymakers will also be interested in the average number of affiliations and service concentrations of all physicians. Tables B-1 and B-2, respectively, report these figures by specialty for all physicians in our seven state sample.

As noted above, the average number of affiliations for attending physicians is 1.55 as compared with 2.25 for all physicians (see Table B-1). This is to be expected given that the full sample is likely to include nominal affiliations (e.g., a courtesy privilege granted for very few admissions). About 44 percent of physicians have 3 affiliations or less. For attending physicians we found that medical and surgical specialists tended to have higher numbers of affiliations. This might be expected given that they are likely to be more oriented toward providing hospital care. For the full sample of physicians, we find that medical specialists have the highest average affiliations (2.50) followed by general and family practice (2.15), "other" specialists (2.10), and surgical specialists (2.09).

In general the same specialties that demonstrated higher than average affiliation rates when we examined attending physicians also demonstrate higher than average rates when all physicians are considered. For medical specialties these include: cardiology (3.69), gastroenterology (2.87), vascular disease (2.52), neurology (2.82), pulmonary disease (3.13), geriatrics (2.96), and oncology (2.97). Three surgical specialties have relatively high average affiliations--thoracic surgery (2.87), urology (2.73), and cardiovascular surgery (2.64).

Table B-2 reports the proportion of RVUs provided in the physicians's primary medical staff affiliation. When attending physicians were analyzed, we found that 90 percent of services were provided in a single, primary hospital. When all physicians are examined, we find that 88 percent of services are provided in a single, primary hospital. The median physician provides 99 percent of his or her services in a single hospital. Only about 5 percent of physicians provide less than 50 percent of their Medicare services in a single hospital.

The concentration percentages by specialty for all physicians are generally consistent with those found for attending physicians. Surgical and medical specialties have somewhat lower service concentrations (86 percent) than general/family practice (90 percent), and other specialties (91 percent). Service concentrations range from a low of 78-79 percent (gastroenterology, urology) to a high of 91 percent (RAPs).

As noted, nationally, 5 percent of all physicians have service concentrations below 50 percent in a single, primary hospital. This figure is lower for general/family practice (3 percent) and other specialty (3 percent) physicians and higher for medical and surgical specialists (6 percent). Between 9 and 11 percent of physicians in gastroenterology, vascular disease, pulmonary disease, oncology, thoracic surgery, and urology have service concentrations of 50 percent or less.

Table B-1
Physician Hospital Affiliations by Specialty
(All Physicians)

			Percent of Physicians by Number of Affiliiation							
Physician Specialty	Mean	Standard Deviation	1	2-3	4-6	7-10	10+	Min	Max	Percent of Physicians
All	2.25	1.72	43.3	40.6	13.4	2.4	0.4	1	29	100.0
GP/FP	2.15	1.40	40.7	45.9	12.0	1.3	0.1	1	15	18.1
Medical Specialty	2.50	1.87	37.3	41.4	17.6	3.3	0.5	1	29	35.5
Internal Medicine	2.53	1.73	32.6	46.5	17.5	3.0	0.4	1	17	13.7
Cardiology	3.69	2.46	16.6	38.0	35.6	8.3	1.6	1	29	3.6
Gastroenterology	2.87	1.57	20.7	49.9	26.5	3.0	0.0	1	10	1.4
Vascular Disease	2.52	1.83	37.0	37.0	22.2	3.7	0.0	1	7	0.1
Neurology	2.82	1.85	25.9	44.7	25.5	3.4	0.4	1	21	1.8
Psychiatry	1.83	1.20	53.9	37.3	8.1	0.8	0.0	1	10	3.0
Pulmonary Disease	3.13	2.03	19.4	48.2	27.1	3.9	1.4	1	16	1.0
Geriatrics	2.96	2.77	21.2	51.9	25.0	0.0	1.9	1	20	0.1
Emergency Medicine	2.59	1.85	33.6	43.6	18.6	3.7	0.6	1	14	1.0
Oncology	2.97	1.81	24.6	43.6	27.4	4.4	0.0	1	10	1.1
Other Medical	1.93	1.69	56.4	32.8	8.0	2.3	0.5	1	25	8.9
Surgical Specialty	2.09	1.31	41.1	47.0	10.8	1.1	0.1	1	14	18.4
General Surgery	2.24	1.37	36.2	48.7	13.9	1.3	0.0	1	10	5.1
Orthopedic Surgery	1.98	1.10	40.4	51.9	7.1	0.6	0.0	1	10	4.0
Thoracic Surgery	2.87	2.06	27.0	46.2	20.8	4.9	1.1	1	14	0.7

Table B-1
Physician Hospital Affiliations by Specialty (All Physicians)
(con't)

Physician Specialty	Mean	Standard Deviation	Percent of Physicians by Number of Affiliiations 1	2-3	4-6	7-10	10+	Min	Max	Percent of Physicians
Urology	2.73	1.51	21.7	53.9	22.5	1.9	0.1	1	11	2.1
Ophthalmology	1.62	0.84	56.5	40.7	2.7	0.1	0.0	1	8	2.7
Cardiovascular Surgery	2.64	1.49	25.1	52.2	19.7	3.0	0.0	1	9	0.4
Other Surgical	1.78	1.11	53.6	39.1	6.7	0.6	0.0	1	10	3.5
Other	2.10	1.91	53.9	32.0	10.7	2.7	0.8	1	26	28.0
RAPs	2.61	2.36	44.4	32.3	16.9	5.0	1.5	1	26	12.4
Other Physicians	1.50	0.88	66.9	29.5	3.4	0.2	0.0	1	8	2.5
Unreported	1.73	1.38	60.4	32.2	6.2	1.0	0.2	1	25	13.1

N = 53,861.

Source: 1991 NCHS File--100 percent claims for seven states.

Table B-2
Percentage of Physician RVUs in a Single Hospital by Specialty (All Physicians)

Physician Specialty	Mean	Standard Deviation	Median	Percent of Physicians with less then 50%	Min	Max	Percent of Physicians
All	.88	.18	0.99	.05	.10	1.00	100.0
GP/FP	.90	.16	0.99	.03	.20	1.00	18.2
Medical Specialty	.86	.18	0.98	.06	.18	1.00	35.6
Internal Medicine	.87	.18	0.98	.05	.20	1.00	13.7
Cardiology	.84	.18	0.93	.06	.23	1.00	3.6
Gastroenterology	.78	.20	0.82	.11	.28	1.00	1.4
Vascular Disease	.81	.22	0.97	.11	.36	1.00	0.1
Neurology	.81	.20	0.88	.09	.23	1.00	1.8
Psychiartry	.87	.19	1.00	.05	.26	1.00	3.0
Pulmonary Disease	.81	.21	0.89	.09	.23	1.00	1.1
Geriatrics	.85	.19	0.95	.06	.26	1.00	0.1
Emergency Medicine	.91	.15	0.98	.03	.31	1.00	1.0
Oncology	.81	.20	0.88	.09	.25	1.00	1.1
Other Medical	.89	.18	1.00	.05	.18	1.00	8.9
Surgical Specialty	.86	.19	0.98	.06	.17	1.00	18.5
General Surgery	.86	.18	0.97	.05	.23	1.00	5.1
Orthopedic Surgery	.85	.19	0.97	.06	.26	1.00	4.0
Thoracic Surgery	.82	.20	0.92	.09	.17	1.00	0.7

Table B-2
Percentage of Physician RVUs in a Single Hospital by Specialty (All Physicians)

Physician Specialty	Mean	Standard Deviation	Median	Percent of Physicians with less then 50%	Min	Max	Percent of Physicians
Urology	.79	.21	0.83	.11	.24	1.00	2.1
Ophthalmology	.89	.17	1.00	.03	.32	1.00	2.7
Cardiovascular Surgery	.86	.18	0.96	.03	.27	1.00	0.4
Other Surgical	.88	.18	1.00	.04	.30	1.00	3.5
Other	.91	.16	1.00	.04	.10	1.00	27.8
RAPs	.91	.16	1.00	.03	.11	1.00	12.5
Other Physicians	.90	.18	1.00	.03	.26	1.00	2.5
Unreported	.91	.16	1.00	.05	.10	1.00	12.8

N = 53,605.

Source: 1991 NCHS File--100 percent claims for seven states.

Appendix C

Comparing Affiliation Rates Using a 100% National File

The previous analysis of affiliation rates and service concentration is based on 1991 100 percent claims data for seven states. Recently the Medicare Patient Analysis and Review (MedPAR) file for 1992 became available. This is a national file which contains 100 percent of Medicare admissions for the year. The file reports the UPIN of the attending physician for each admission as determined by the hospital. Below we use this file to replicate the basic affiliation and concentration analysis performed with the seven state file. Replicating and comparing allows us to address two questions. The first, and most obvious, is whether conclusions based on a seven state database are generalizable across the U.S. The second question is whether our methods of defining the attending physician are consistent with hospital's identification of the attending.

Data

The national analysis, based on the MedPAR data, differs from the seven state analysis in four ways. First, it pertains to all admission in the country for 1992. Thus the national file represents 250,320 physicians and 5,309 hospitals, while the seven state analysis examined 33,756 physicians and 818 hospitals. Second, the attending is defined by the hospital rather than based on the services provided during the admission. Third, since RVUs have not been assigned to admissions on the national file, we are unable to remove nominal affiliations. Thus in the national file an affiliation is defined as any hospital in which a physician is the attending for at least one admission during the year. Fourth, in computing the concentration of services we used RVUs in the seven state file. However, since RVUs are not available, in the national file we use admissions.

Number of Affiliations

Table C-1 compares the average number of affiliations by specialty. Overall, attending physicians average 1.55 and 1.56 affiliations in the seven-state and national files, respectively. In both files, 63 percent of physicians have only one affiliation. By specialty group there is little difference in the number of affiliations between the files. In the seven-state and national files, respectively, surgical specialists have the most affiliations (1.76 versus 1.72), followed by medical specialists (1.62 versus 1.58) and then general practitioners (1.34 versus 1.42).

Concentration of Services

The results of the concentration of services analysis for the two files are compared in Table C-2. Concentration of services refers to the proportion of an attending physician's work performed in his or her primary affiliation. In the seven-state file the concentration of services was measured as the average percentage of a physician's[1] RVUs in their primary hospital (i.e., the hospital with the highest percentage of their RVUs). In the national file the concentration was measured as the percentage of admissions in the primary hospital. Again, there is very little difference in the results generated by the two files. Overall, the seven-state analysis found that on average 90 percent of a physician's services were provided in one primary hospital, the national analysis found 91 percent. As would be expected, both files show the practice of surgical specialists is less concentrated (about 87 percent) than that of medical specialists (about 90 percent) and general/family practice (93 percent). (The "Other Physician" category is the most highly concentrated, about 95 percent.)

Specialty Distribution

Table C-3 compares the specialty distribution of attendings in the seven-state sample with that of the national file. Most of the difference between the two distributions results from the large percentage of physicians in the unreported group in the seven-state sample (9.5 percent). In the national file, specialty was reported by all physicians. It appears that the unreported physicians in the seven states were often shifted into the "other" categories in the national file. The percentage of physicians considered other medical, other surgical and other physician were higher in the national file than in the seven-state file by 3.1, 0.7, and 2.9 percentage points, respectively. The 1.4 percentage point increase in physicians reporting their specialty as internal medicine in the national file may also have resulted from classifying the unreported. There are one percentage point increases in the psychiatry and ophthalmology specialty groups in the national file. Overall, however, there is very little difference in the distribution between the two files.

Discussion

In general, the analysis of the national file and of the seven-state sample tend to support one another. Although there are differences in the measure of concentration and in the method of defining the attending in the two files, these differences appear to have little impact on the results. Attending physicians average about one and a half affiliations, 63 percent have one affiliation, and about 90 percent of their services are provided in a single primary hospital. Although we cannot directly compare the methods of defining the attending, the specialty distribution of attendings strongly suggests that the two methods produce similar results.

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[1] Recall that for a given admission, services provided by any physician were assigned to the attending.

Table C-1
Number of Affiliations by Specialty
7 State versus National File

	Number of Affiliations	
Specialty	7 States[1]	All States[2]
All Physicians	1.55 (62.8)[3]	1.56 (62.5)
GP/FP	1.34	1.42
Medical Specialties	1.62	1.58
Internal Medicine	1.63	1.60
Cardiology	1.94	1.98
Gastroenterology	1.88	1.82
Vascular Disease	2.17	2.02
Neurology	1.60	1.54
Psychiatry	1.13	1.17
Pulmonary Disease	2.05	1.90
Geriatrics	1.62	1.51
Emergency Medicine	1.14	1.25
Oncology	1.95	1.87
Other Medical	1.39	1.41
Surgical Specialties	1.76	1.72
General Surgery	1.74	1.69
Orthopedic Surgery	1.70	1.76
Thoracic Surgery	2.20	2.08
Urology	2.19	2.15
Ophthalmology	1.16	1.27
Cardiovascular Surgery	2.08	2.04
Other Surgical	1.52	1.58
Other	1.26	1.25
RAPs	1.05	1.12
Other Physicians	1.21	1.35
Unreported	1.33	N.A.

[1] This file includes 100% of Medicare admissions from July-December 1991, for Alabama, Florida, Indiana, Kansas, Missouri, Oregon, and Utah. "Nominal" affiliations, those in which the attending provided less than 10 RVUs, were removed from the file.
[2] This file includes 100% of Medicare admissions for 1992.
[3] Percent of physicians with one affiliation.

Table C-2
Concentration of Services or Admissions by Specialty[1]
7 State versus National File

	Concentration in Primary Hospital	
	7 State[2]	All States[3]
All Physicians	0.90	0.91
GP/FP	0.93	0.93
Medical Specialties	0.89	0.90
Internal Medicine	0.89	0.91
Cardiology	0.86	0.87
Gastroenterology	0.83	0.86
Vascular Disease	0.80	0.85
Neurology	0.88	0.89
Psychiatry	0.97	0.96
Pulmonary Disease	0.83	0.86
Geriatrics	0.91	0.92
Emergency Medicine	0.96	0.95
Oncology	0.84	0.87
Other Medical	0.91	0.91
Surgical Specialties	0.86	0.88
General Surgery	0.87	0.89
Orthopedic Surgery	0.86	0.87
Thoracic Surgery	0.83	0.85
Urology	0.80	0.83
Ophthalmology	0.96	0.93
Cardiovascular Surgery	0.86	0.87
Other Surgical	0.90	0.88
Other	0.94	0.95
RAPs	0.99	0.97
Other Physicians	0.95	0.94
Unreported	0.92	N.A.

[1] In the seven-state and national file respectively, concentration measures the percentage of a physician's services (RVUs) or admissions in one primary hospital.

[2] This file includes 100% of Medicare admissions from July-December 1991, for Alabama, Florida, Indiana, Kansas, Missouri, Oregon, and Utah. "Nominal" affiliations, those in which the attending provided less than 10 RVUs, were removed from the file.

[3] This file includes 100% of Medicare admissions for 1992.

Table C-3
Comparison of Specialty Distribution
7 State versus National File

Specialty	Percent of Attending Physicians 7 States[1]	 All States[2]
GP/FP	20.1	20.1
Medical Specialties	43.9	49.2
Internal Medicine	18.3	19.7
Cardiology	5.3	4.8
Gastroenterology	2.1	2.1
Vascular Disease	0.1	0.1
Neurology	2.4	2.1
Psychiatry	1.6	2.6
Pulmonary Disease	1.6	1.6
Geriatrics	0.1	0.2
Emergency Medicine	0.5	0.9
Oncology	1.2	1.2
Other Medical	10.8	13.9
Surgical Specialties	22.8	24.2
General Surgery	7.4	7.6
Orthopedic Surgery	6.0	5.8
Thoracic Surgery	1.0	1.1
Urology	3.2	2.9
Ophthalmology	1.6	2.6
Cardiovascular Surgery	0.6	0.5
Other Surgical	3.0	3.7
Other	13.1	6.6
RAPs	2.8	2.8
Other Physician	0.8	3.7
Unreported	9.5	0.0
Total Number of Physicians	33,756	250,320

[1] This file includes 100% of Medicare admissions from July-December 1991, for Alabama, Florida, Indiana, Kansas, Missouri, Oregon, and Utah. "Nominal" affiliations, those in which the attending provided less than 10 RVUs, were removed from the file.
[2] This file includes 100% of Medicare admissions for 1992.

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